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THE

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THE SUPERSESSION OF THE TROLLEY.

A MILD thrill of surprise may have been felt by readers of the *Westminster Gazette* last week when they read the declaration of the doom of the trolley from no less an authority than Dr. Silvanus Thompson. It was not the only paper in which the Doctor enacted the *rôle* of the prophet, for we recollect seeing a similar statement in one of the great Lancashire papers. The hostile attitude to the trolley and all its works is shown in the last lines of the letter published in our London contemporary. Says Dr. Thompson: "If in Monaco electric cars can be run without overhead wires, and without a slot in the roadway, or a conduit under the slot, it is certain that they can be run in England also. In fact, a short line on private ground is running in the north of London. London has done well to wait for something better than the overhead trolley wire. But the slot conduit is not the alternative nor the best alternative." The question that naturally arises is, what is the best alternative? The answer is given clearly and emphatically in the *Pall Mall Gazette* of the 13th inst., wherein is described with much garniture the Thompson-Walker surface contact system, which shows that there was more in Dr. Thompson's letter than appeared on the surface. We are not going to waste any time by traversing the non-technical statements of our contemporary, it is obviously in the hands of its writer, who has apparently considered the subject of tramway traction with the open mind that proceeds from a limited knowledge.

Nor do we wish to condemn off-hand the system invented by Dr. Thompson and Mr. Miles Walker. We believe it has—and Dr. Thompson will forgive us for saying so—some ingenious features. So also had Lineff's, the Claret-Veulliemer, Kent & Pringles's, the Westinghouse, and the host of others which were expressly invented to supersede the trolley. There is no branch of electric propulsion that presents more allurements to the inventor than the surface contact system, and scarcely no subject has called for a larger number of patents. They lie, for the most part, decently interred in the recesses of the Patent Office, albeit occasionally disturbed by some eager inventor, anxious to know if he has been anticipated. For all we know, the field in the north of London may be the cradle of the future universal system of electric traction, and Prof. Thompson may, by the aid of his invention, sweep away the "hideous erections" of to-day.

But when he declares through the medium of the newspapers that the trolley is doomed, he ought to tell the public why he thinks so, considering that of 204 companies in Europe, 173 employ the overhead system, and only eight are worked from underground. It is no new experience for an inventor to take an exalted view of the product of his brain, and we see no reason to acquit Dr. Thompson of taking an exaggerated measure

of his invention. When the system, which is being tried in a field at Willesden, has convinced experts of its utility under practical every day conditions, there will be a boundless field for it to exploit.

It has been an uphill struggle to convince the public authorities of this country that the overhead wire system is neither so dangerous nor so unsightly as many have declared it to be, and many have, in spite of conduits, and notwithstanding surface contact systems, declared themselves in favour of it. Only on Tuesday, at the meeting of the London County Council, the Rev. Fleming Williams spoke of a recent visit to Halifax, where the overhead system was in use, stating that he went there prejudiced against it, but now, from practical experience, approved of it. No one argues that it is perfect, but the method which is going to supersede it has to convince the army of practical men who have been responsible for the 30,000 miles of overhead trolley which exists to-day. Dr. Thompson's utterances may be useful to such bodies as the County Council, the majority of whose members have a rooted aversion to overhead wires; but though it may help to stave off such systems for London, we do not think we shall be brought any nearer to a surface contact method. The former has proved its utility and its limitations, but the latter has not.

Still, as we shall probably have examined the system before our next issue is published, we will reserve any remarks on mercury switches, relative costs of conductors, and permanent ways *sine die*.

Electricity and the Utilisation of Waste Products.

In the winning of metals, as is well known, immense quantities of waste products are formed. It is extremely difficult in practice to obtain more than a moderate percentage of the metal from the ores and much of it is lost. But there is another direction in which vast masses of material are produced in metallurgical operations which cannot be utilised, and the great slag heaps which are to be found in the vicinity of blast furnaces tell their own story. Of late years some attempt has been made to convert slag into bricks, mortar, and cements with some success in Germany and America; but little effort has been made in this country up to the present. A means of dealing with the slag has recently been discovered by H. L. Hartenstein, a metallurgist of Bellaire, Ohio, by which the waste products from metallurgical furnaces can be utilised. Molten slag is mixed with very finely divided carbon (coke dust), and subjected to the action of a powerful electric current, whereby the carbon and the oxides in the slag react to form carbides of calcium, aluminium, and silicon. The mixture may be made cold, and reducing gas may be injected whilst it is being heated electrically. Or the carbon, suspended in the waste gases from the blast furnace, may be injected into the molten slag. Three parts of slag should be incorporated with one part of carbon. The operation is conducted in a rotatory converter, mounted on hollow trunnions, and divided into two compartments, so arranged that by the rotation of the vessel, the fluid charge may be run from one to the other. One of these compartments is provided with tuyeres communicating with the trunnions; the other has electrodes, through which the current is introduced. The blast pipe outside the trunnions is fitted with a hopper and a rotating feed for introducing the coke-powder into the blast. One trunnion may be used with reducing gas and one with air, the gases being mixed at the tuyeres. The molten slag is introduced into, and the fluid carbides are poured from the converter, through the nose. We recently heard of another process for introducing carbides which is being exploited by J. Landinof, Stockholm. The pulverised raw materials of the carbide which it is desired to produce (oxide or carbonate of lime and carbon in making carbide of calcium, silicic acid and carbon for carbide of silicon, and so on), are mixed together with the addition of a proportion of tar or other raw material containing hydrocarbon, and are formed into briquettes by heating and pressure, with or without the addition of some flux containing the substance the carbide of which is to be produced; for instance, calcium chloride in the case of calcium carbide. The uniform mass thus produced is introduced, with or without preliminary heating, between the carbons of an electric furnace, the electrodes of which may be made movable about their longitudinal axes to obviate their slagging together with the bloom formed.

Polarisation of Electric Radiation.

Prof. Chunder Bose in a paper read before the Royal Society last March, described further experiments on the polarisation of electric radiation by lamellated and fibrous structures. He had shown in a previous communication that a pair of books may be conveniently used as a polariser and analyser, the layers of leaves transmitting only radiations polarised in their own plane. In this paper further details are given of the construction and use of a convenient polariscope on these lines. He had previously found that a bundle of parallel fibres, such as jute, held at an angle of 45° with the direction of radiation, produces double refraction, the velocity of propagation in planes parallel to the fibres being different from that in planes at right angles to them. If the bundle be placed so that its fibres are parallel to the direction of radiation no effect is produced. He now shows that if the last bundle be twisted, forming such a structure as a piece of spun yarn, the plane of polarisation is rotated, the direction of rotation changing with the sense of the twist Such a bundle has no polarity, its properties are identical at the two ends, it may be reversed in direction without affecting its action, and similar bundles in all possible directions will produce rotation in the same sense. Space through which the radiation is being transmitted may be filled with such bundles, and their action will be additive. If the radiation after passing through a space filled with such bundles were reflected so as to return through them, the plane of polarisation in the second passage would be rotated through the same angle as in the first passage, but in the opposite sense, so that it would finally emerge polarised in the same plane as that in which it entered. If the radiation passes through two equal bundles twisted in opposite senses, the two neutralise one another's actions, and the plane emerges as it entered So if the space be filled with bundles, one half twisted in one sense, the other half in the other, the resultant action will be *nil*. Prof. Bose observed that this structure is a very perfect analogue of the action of the two varieties of sugar. Dextrose turns the plane of polarisation of light in one direction, levulose in the other, while an inactive variety may be obtained by mixing the two. The comparison is of great interest, inasmuch as no mechanism had previously been suggested by which, without any molecular polarity or crystalline arrangement, which could not be supposed to occur in a liquid solution, rotation of the plane of polarisation could be obtained. Prof. Bose clearly distinguished between the two cases in which rotation of the plane occurs. (1) The rotation induced by magnetic field: this rotation among other things is dependent on the direction and intensity of the magnetic field, and is doubled when the ray is reflected back. (2) The rotation produced by saccharine and other solutions, when the rotation is equal in all directions and simply proportional to the quantity of active substance traversed by the ray. The rotation in this case is neutralised when the ray is reflected back. It is not difficult to see how the first effect can be produced on the sort of hypothesis used by Prof. Poynting to explain the Zeeman effect. (See articles in Electrical Review, October 7th and 14th), and by Prof. Fleming to explain the magnetisation of iron; but Prof. Bose has been, we believe, the first to suggest a mechanism which might produce the second effect. This mode of attacking the problem of the fine constitution of matter in relation to light, by means of coarse structures and radiations of comparatively long wave length, promises further interesting results.

DROP IN VOLTAGE IN SHUNT-WOUND DYNAMOS.

Writing to the New York *Engineer* on this subject, Mr. A. R. Curtis says :—

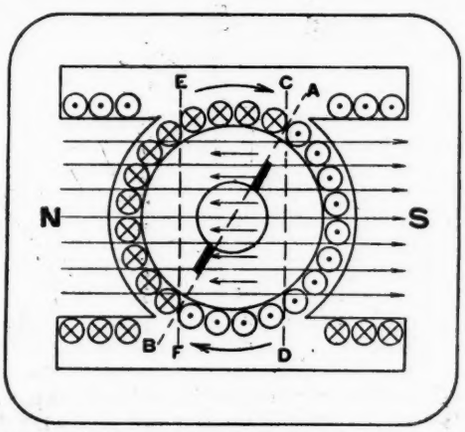
"Perhaps one of the most puzzling questions to the ordinary station superintendent or engineer is why the voltage drops in a shunt-wound machine as the load increases, and why cutting out resistance in the fields brings the voltage up.

"The three primary factors which determine the number of volts which a dynamo is generating are the speed, the number of conductors (amount of wire on the armature), and the strength of the magnetic field as set up by the field coils.

"Right away then we can account for a part of the drop, since we know that all steam engines and water wheels will slow up slightly with any increase of load.

"After an armature is once wound the amount of wire on it, of course, is fixed, so that this does not effect the voltage.

"We must look for the main cause then in a decrease of the strength of the field. For convenience the strength of any field is measured by the number of so-called magnetic lines flowing out of the north pole into the south just the same as we measure the strength of a current by the number of amperes flowing from a positive pole to a negative pole.



Arrows passing straight across the machine represent the main magnetic lines. The small circles represent end of wires. Those in the corners are on the field coils, and those surrounding the large circle, are on the armature.

"These lines, of course, are set up by the field coils which are wound round and round the coils.

"Suppose the figure to be a section taken right down through the middle of a two-pole machine perpendicular to the shaft. The ends of the wires on the fields and on the armature are shown by the circles.

"Those which have crosses in them represent wires in which the current is flowing away from the observer and those with dots in them represent wires in which the current is flowing towards the observer.

"The figure shows the directions of current and of rotation of the armature when the machine is generating current, and with the brushes set on the line, A B.

"This line, A B, is called the line of commutation, and the currents in the armature on either side of this line always flow in opposite directions as here shown.

"The brushes on nearly all dynamos are shifted ahead (from the vertical), so that with all dynamos that are running there are a certain number of conductors at the top with current in them in one direction, and the same number at the bottom of the armature with current in them in the opposite direction. This is shown here between the lines C D and E F.

"Now notice that these conductors form just the same as a third field coil which *always* acts just opposite to the main field coils. As the current in the armature increases, the *demagnetising* effect of these conductors increase, thus cutting down the strength of the field and thus dropping the voltage.

"But the drop in the voltage due to this, and the decrease in the speed will cause a still greater drop in the voltage due to the following reason :—

"Shunt fields are connected across in parallel between the two terminals of the dynamos, and hence the current flowing in them will depend upon the difference in voltage between these terminals so that this first drop (as it were) in voltage cuts down the current flowing in the field coils, which in turn lessens their magnetising power, which in turn drops the voltage still further.

"Again, as the load increases the whole machine gets warmer and this increases the resistance of the armature, which, being a part of the whole circuit, drops the voltage slightly and this same heat increases the resistance of the field coils, thus again decreasing the current flowing through them.

"The immediate effect of an increase of load then is :—

"1. Drop in speed.

"2. Decrease in strength of field.

"3. Increase in resistance of armature and field coils. The secondary effect of all three of these is to drop the voltage and this drop acts to cause still more of a drop.

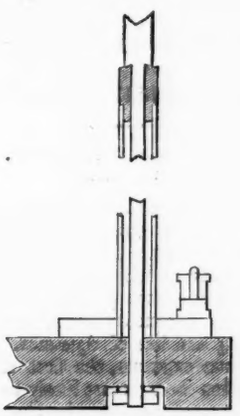
"Cutting out resistance in the circuit with the field coils simply allows more current to flow through the field coils thus increasing this magnetising effect sufficiently to bring the voltage up to what is wanted.

"This means that the field coils were made stronger than was necessary when the dynamo was built."

AN IMPROVED ELECTROLITIC STAND.

Those who do research work in electrolysis have felt for some time the need of an improved stand. Dr. Hugh Marshall has succeeded in supplying this want, and at a recent meeting of the Scottish Section of the Society of Chemical Industry he exhibited one of these new apparatus.

The improvement in the electrolytic stand consists primarily in the method of making connection with the electrodes. In most stands the connecting wires are brought directly to the supporting arms, which are insulated from one another by means of glass rod forming part of the supporting rod or of one of the arms. The wires in such a case are very apt to get in the way, especially when space is



limited, and the stand may be shaken or upset by the wires becoming entangled with other apparatus, &c., while being shifted. This is avoided in the present stand by bringing the wires to fixed terminal binding screws in the base, which is made of suitable insulating material, and these terminals are in direct connection with separate parts of the supporting rod bearing the electrode arms.

The base of the stand consists of a slate block 6 inches × 4 inches × 1 inch. The lower part of the vertical support consists externally of a glass tube 6 inches × ½ inch, having at its lower end a flange about 2 inches in diameter, and about ¼ inch thick. The under side of this flange has two projecting pins which fit into corresponding holes in the slate. The upper end of the tube is fitted with a vulcanite collar through which passes a brass rod 15 inches long.

Above the collar this rod has a diameter of $\frac{3}{8}$ inch; the remainder is only about half that thickness. The narrower portion passes axially right through the brass tube and through a hole drilled in the slate base near one end; the under side of the slide is countersunk to allow of a brass nut being screwed on to the end of the rod. A binding-screw terminal is fitted on the base at the side, being held in position by a nut also sunk into the under side of the slate; it is connected with the central rod by means of a stout copper wire or strip also embedded in the slate. The other binding screw is fixed directly on the flange of the brass tube.

To put the parts of the apparatus together the bottom of the flange is first covered with waterproof cement and placed in position over the hole in the base; the vulcanite collar is inserted into the upper end of the brass tube, and the rod passed through so that its shoulder rests on the collar and the screw end fits into the hole in the slate; the loop of the connecting wire or strip is placed over the end of the rod, and the nut finally screwed tightly on, binding all firmly together. The lateral screw is fixed in position in a similar manner, after which the hollowed out parts on the bottom of the slate are filled in with wax or cement to protect the connections.

The figures represent sections through the two principal parts of the apparatus—the vulcanite collar and the end of base.

In this way the central rod is insulated from the surrounding tube and held in position by the slate and the vulcanite collar, and each part of the support is connected with one of the terminals. The electrode supports consist of a brass ring with boss fitting fairly closely on the brass tube, and of a brass rod with boss similarly fitting the upper part of the vertical rod. The cathode ring has the usual three small platinum studs to support the basin. The extremity of the anode rod is composed of a binding screw and washer to clamp the anode wire. All non-contact parts are lacquered, or, better still, the whole external metal surface may be gilt or platinised.

The electrode supports can be freely moved about their respective parts of the vertical support without the least trouble from the wires. The terminal connection being close together and in a fixed position on the stand, a flexible insulated double lead may conveniently be used for joining up. All binding screws are Post Office pattern.

NOTES ON COMMUTATOR DESIGN.

By F. J. A. MATTHEWS.

Considering that many makes of direct current dynamos and motors can now be bought with an efficiency of from 85 to 94 per cent., and that by the expenditure of so many more pounds a higher degree of efficiency can easily be obtained, designers have now only two problems to consider, first, to cheapen the cost of production, and, secondly, to improve the general running and life of dynamos. With increasing wage rates and shop expenses, the first seems improbable, the cost of production being more likely to have an upward rather than a downward tendency in the future; there is, however, ample room for improvement in many of the machines now on the market, but this improvement can only be brought about by paying attention to details.

It is questionable whether in cotton mills, for instance, where the hours of lighting do not exceed 500 per annum, it is not more economical for the mill owner to purchase for less money a dynamo having a lower percentage of efficiency than pay a high price for a machine with an efficiency of 94 per cent., as the saving in coal is not commensurate during such short runs with the percentage set aside for depreciation and interest. But what is of the very greatest importance is that the machine when set to work should run with the minimum of attention and absolutely no sparking. This defect of sparking, in a greater or less degree, is most prevalent in mill dynamos, and yet if only one half of the attention devoted by designers to attempt to screw 1 per cent. higher efficiency out of the machine were paid to details both in the drawings and also while the work was passing through the shops, very few complaints would have to be made on this account.

The causes of sparking may be classified as follows:—

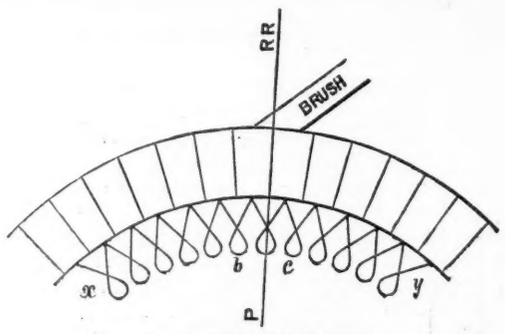
1. Faults inherent to the dynamo design.
2. Faults due to bad setting of the brushes.
3. Causes entirely outside the machine.
4. Faulty construction of the commutator.
5. Bad connections.
6. Commutator too small.

In the present article we are more concerned with the three latter causes, and so may briefly dismiss the first three.

1. These faults are, broadly speaking, two-fold:

(*a*) Unsymmetrical winding; (*b*) too weak a field, and each denotes lack of experience and bad designing.

2. These faults are again two-fold: (*a*) brushes not being diametrically opposite, and not on the neutral plane; in either case this is more a matter for the dynamo attendant, although the designer should contrive to secure such a degree of fixity of lead, that the lead of the brushes does not require to be altered with every slight fluctuation in the load; (*b*) the brushes not bearing on sufficient width of the commutator, the brushes should be set to cover one and a half sections, plus one and a half pieces of mica. Referring to fig. 1,



P R R, plane of requisite reversal.

Fig. 1.

where the brush covers one section only, the coil, c, just coming under the brush, is carrying current in a right-hand whorl; but when it reaches the position of the coil, *b*, it will have to carry current in a left-hand whorl, as it will have passed from the *y* series into the *x* series of coils; therefore, while short-circuited under the brush, the current must first die away, and in order to obtain sparkless commutation, a reverse current of the same strength as that carried by the *x* series of coils must be generated in it. Take the case of a commutator built up with 60 sections, and running at 1,200 revolutions per minute, the time each section is under the brush is $\frac{1}{1200}$th part of a second, and we know that, in accordance with Lenz's laws, there will be a force opposing

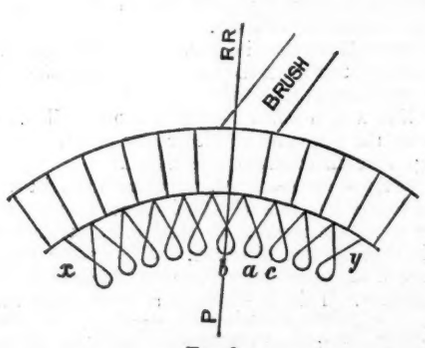


Fig. 2.

the dying away of the current, and then a force opposing the generating of a current in the opposite direction, in addition to which the coil must be exactly in the plane of requisite reversal; the time for all these forces to act is very short. It is not impossible to get sparkless commutation with a

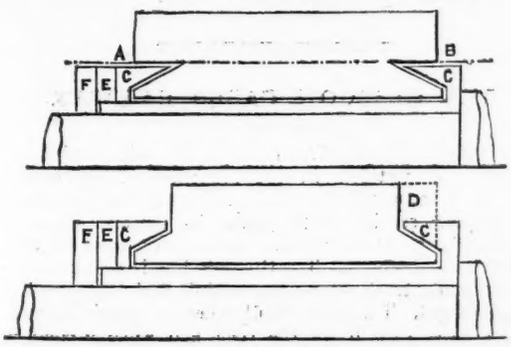
brush covering only one section; in fact, many machines are so running, but to put a dynamo under the charge of the ordinary dynamo attendant found in a mill, with brushes so set, is a little risky, as the condition for sparkless commutation in such a case is, that the plane of requisite reversal must be exactly through the centre of the coil, and the slightest variation in the load will have a tendency to shift this plane and thus cause sparking. In fig. 2 the brush is shown covering one and a half sections; here two coils are short circuited in place of one, as before, with the result that the total time under the brush is very considerably longer; the plane of requisite reversal will now lie through the centre of coil *c*, so that the current in any coil coming up under the brush will have time to die away, and even a slight reverse short circuit current may be generated in the coil before arriving at the plane of requisite reversal. Should, now, this plane vary owing to a fluctuation in the load, the sparking will in no case be as heavy as it would with a similar fluctuation were the brushes covering one section only.

3. These faults are caused either by (*a*) vibration of the dynamo, (*b*) bad joint on the belt causing the brushes to be continually lifted up and down, (*c*) leakage on the outer circuit. They have, in reality, nothing to do with the design, but attention should be paid to these points by whoever puts down the dynamo.

Having glanced thus briefly at these preceding causes of sparking which are not due to the design and construction of the commutator itself, we will now deal more fully with faults which can, and ought to, be guarded against when the commutator is either designed or in process of being built.

4. The conditions for a sound commutator are, that it shall be absolutely rigid, evenly balanced, truly turned axially with the shaft, and that the metal shall be homogeneous. Another condition is, that each segment shall be thoroughly insulated from its neighbours and from the sleeve.

Absolute rigidity can only be attained by the exercise of the utmost care, not only in the design, but also in the building up of the commutator, for in all commutators the method of holding the various segments together is very far removed from being a sound mechanical construction. This is caused by the fundamental condition that the segments may not be directly held by metal, whilst at the same time they are acted upon by various strong forces, such as centrifugal force due to rotation, friction due to the brushes, and expansion due to the rise of temperature in the commutator during a run. Except in commutators of large size, there are practically only two ways of holding the segments together, represented in figs. 3 and 4. Various makers differ slightly from



Figs. 3 and 4.

these two methods, but they are only variations of the same principle. Each of these two methods has its advantages and its disadvantages. For the type shown in fig. 3 there can be claimed that less length is required on the shaft for nuts and rings, with a consequent saving in length of the sleeve and bed plate, and also that with rolled copper bars the sections can be cut for connecting lugs from the inductors before the commutator ends are turned up. On the other hand, the life of the commutator is short, for as soon as it has worn down to A B, the brushes will rest on the rings, C C; while with the type shown in fig. 4 the great advantage is the longer life of the commutator, which can now be worn down to the very bottom; the disadvantages being, first, the longer length required on the shaft, and secondly, and more important, the greater amount of time in building up the commutator when made of hard rolled copper bars, as the various segments have first of all to be put together, and the dotted part, D, fig. 4, must be turned off, and the whole taken in pieces again before the commutator lugs can be attached, the time of this building up and undoing being saved if the type of fig. 3 be adopted. Each manufacturer must decide for himself which of these methods is the best, as neither of them has any real advantage as regards the solidity of the commutator; what is of real importance is that the rings, C C, should well cover the V's of the segments so as to secure a good grip.

In a commutator with bars 1½ inches deep, 6 inches long, 8 inches external and 5 inches internal diameters, running at 1,200 revolutions per minute, the centrifugal force tending to throw the bars outwards is equal to 2,700 lbs., or with 60 sections in the commutator to 45 lbs. per section. Between the collar, C, and the V of the sections some insulating material must be placed, and even to-day many of the smaller makers use for this purpose fibre washers, one of the very worst materials possible, as not only is it hygroscopic with consequent varying degrees of hardness and rigidity, but it also, under the action of heat, rapidly deteriorates in other ways; and it will be readily seen that if it once only slightly looses its hold the high centrifugal force will cause some of the sections to rise, and the result will be disastrous to the commutator, rapid wearing away and oscillation of the brushes, and development of flats owing to the sharp edges and unevenness of the risen bars. The only substances that up to the present have proved of any serviceable nature for these washers are either pressed mica or micanite, and considering that Messrs. Bergtheil & Young now issue an illustrated price list of micanite commutator washers suitable for all sizes, and that the cost of these does not exceed the cost of fibre ones, there is no longer any excuse for the use of washers made of the inferior substance. Another fault which may arise, and in many cases has done so, with the use of fibre washers, is

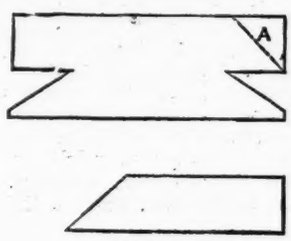


Fig. 5.

for the outer ring to loosen its hold, and the friction of the brushes causes the commutator bars to become inclined at an angle, instead of being parallel with the shaft, with the result that the outer brushes have a forward lead in comparison with the inner brushes; this is a case which the writer has observed in more than one machine which he has been called in to inspect after some months of use. Even employing mica, or micanite washers, it is of the highest importance, in order to prevent subsequent slip, to see that the nuts are well tightened up; this can only be done by having the commutator heated after the first tightening up, and upon allowing to cool, again screwing the nuts up in the lathe; further, the nut, E, (fig. 3) securing the commutator to the sleeve, should either be in duplicate, or should slightly overhang the sleeve, so that the nut, F, securing the sleeve to the shaft, may act as a check nut.

Another point of vital importance is to see that the commutator segments, washers, sleeve, &c., are entirely free from all dirt, turnings, borings, or filings, as the presence of these in the commutator will cause rings of fire running round the commutator, and although in all probability this dust will soon burn out, and give no further trouble, yet in building such a delicate piece of mechanism as a dynamo, a good manager will leave nothing, that is avoidable by the exercise of a little close attention, to chance.

5. In order to prevent the formation of flats, owing to

some bars wearing away faster than others, it is necessary to secure the same degree of hardness in all the bars, by using a perfectly homogeneous metal; but copper being a metal that varies so greatly in the melting pot, the use of cast segments must be abandoned, and hard rolled copper substituted. The worst of this is, that either the bars must be made to the top of the lugs and then turned down along the blade—which would make a thoroughly sound piece of work, but is too costly for any manufacturer to seriously entertain the idea of—or else lugs must be let in. The usual method is to make a saw cut at an angle of 45° and then let in a copper strip lug, as shown in fig. 5; when this is done, it is most important that the connection at A should be thoroughly sound, as it is owing to bad contacts that a vast amount of heating arises in electrical work. The only method which recommends itself to the writer is to have a saw cut through the centre of the bar and solder, or preferably braze, the lug in, and then to drill and rivet it.

6. Above all, the commutator should not be too small for its work; it is frequently stated in dynamo specifications, "no part of the machine to rise more than 70° F. above the surrounding atmosphere at the end of six hours' run with full load;" this, as regards the commutator, is far too high. Take the case of the commutator referred to above; if this rises to 70° F. it would tend to lengthen ·0005 of an inch, and if the insulating ring is not thoroughly rigid it would give, and upon cooling the commutator would be slack, and the troubles enumerated before would arise upon the next run. If the insulating washers are absolutely rigid, then they and the sleeve, nuts and end rings, C C (fig. 3), would have to withstand a stress of something like a ton to the square inch, and the consequences might be very serious, for while the whole might stand firmly together, still the danger, with innumerable successive runs, would be very great, of either the sleeve giving way and breaking, or else of the bars buckling in the centre, when we should have the old sequence of events, rapid wearing away of the brushes, owing to the sharp edges and the development of flats. Here, again, the good designer will leave nothing to chance, but will do away with all fear of danger by making a commutator of such ample section that the heating effects shall not cause any such rise in temperature. Even with a considerably less rise there will always be a strain on the sleeve, and hence is seen the necessity of making this of gun-metal of ample section.

As we saw at the first, a commutator is a most unmechanical construction, judged from an ordinary engineer's point of view; yet with careful designing and supervision during construction, and in the hands of an attentive dynamo tender, there is no reason why this, which has always been the weak part of direct current machines, should not thoroughly retrieve its character, which a little time ago it was fast losing.

ELECTRIC BELTS IN AMERICA.

THE following comments, reproduced from the New York *Electrical World*, in regard to electric belt impostures in America, will be read with considerable interest by those who are acquainted with the history of electrical quackery in this country, especially the electric body-belt branch of the business. Why does not our contemporary commence a righteous warfare in the camp of those who are responsible for the impostures? The country which has done so much to encourage legitimate electro-medical science should hardly allow the quack to be so rampant, while England is, *for the moment*, tolerably free:—

"The country newspapers having a circulation among farmers, and the religious weekly having a circulation among families, seem to be the principal places in which one reads advertisements of 'electric belts' for the cure of all kinds of disease to which the human frame is liable. As has been pointed out recently in these columns, it seems to be the duty of the electrical press to expose, wherever possible, the fakirs who do so much to bring the profession into discredit, and to throw a certain obloquy upon the name of things electrical. Among these are the enterprising manufacturers of the remarkable mechanisms known and advertised as 'electric belts.' The advertisements guarantee the wearer of one of these an immunity against pretty nearly everything but a violent death, and generally tell, in learned terms, about the benefits to be derived from the more or less powerful currents of electricity generated by their appliances and absorbed into the system of the wearer.

"In the first place, if it were true that the beneficial results to be derived from the application of electric currents to the body amount to the half of what these fakirs claim, the use of electricity ought to be carefully restricted to practitioners who understand its application. So powerful a medicament can only be dangerous in the hands of the unenlightened, for all the agents of the pharmacopœia that possess great curative power are also able to do equally great damage if wrongly or ignorantly administered. This view of the matter is, however, based upon the purely gratuitous assumption that electric currents have any directly beneficial effect upon the system. If this be true, it certainly is not proven. While, in the hands of competent specialists, the use of electricity in the treatment of disease is a recognised and valuable means, it by no means follows that the mere putting of part of the body in an electrical circuit will have any effect whatever, save a disastrous or at least uncomfortable one, if the current is strong enough. Hence the pretensions of the makers of electric belts are ridiculous, even assuming that their contrivances produce a current at all.

"As a matter of fact most of them do not produce a current of measurable volume. They are generally made of bits of copper and some other metal, cut into more or less fantastic shapes, and grouped together in a structure such that they are in contact with the skin of the wearer. Under these circumstances there is, no doubt, some potential difference set up between the metals, but it is, of course, immediately destroyed by the metallic contact between them. If it were not—that is, if there were a genuine potential difference maintained between particles of dissimilar metals in contact with the human skin—the phenomena of cataphoresis would certainly ensue and the substance of the metals or their oxides would be carried locally into the wearer, who would discover this fact by the breaking out of sores where the belt was in contact with him. As a general thing the makers guard against this unhappy possibility by so elaborately short-circuiting their metals that not a trace of a volt can be found anywhere about the belt.

"The whole thing is ridiculous, were it not for the fact that sick people are swindled out of their money by the purchase of these things. It is possible that they even sometimes perform a genuine cure, if the disease afflicting the wearer is of nervous origin and he has sufficient faith. It is well known that a potato carried in the pocket will cure those who think they have rheumatism. So will an electric belt, but the potato is just as good and cheaper."

THE GLASGOW CABLE RAILWAY.

THIS solitary example of an underground cable road is held to have been justified by the conditions of the service. Cable roads are peculiarly suited to lines of heavy gradients and frequent service, for the grades balance over the whole circuit and descending cars give back work to help the cable to haul ascending cars. The Glasgow line is a circular railway of double track, run in two tunnels, and there is a rope in each tunnel. The circuit is 6½ miles. *Cassier's Magazine* says it twice dips below the river, and while it competes with the surface trams and the steam railways above, it also serves portions of the city not otherwise served.

Weighted with much purchased property along its route, the tunnels are not generally deeply buried—as little as 7 feet in one place—but averaging 29 feet throughout. The sharpest curve is 680 feet radius, the gradients under the Clyde are 1 in 18 and 1 in 20. The rails are only 60 lbs. per yard. Stations are all at the top of gradients of 1 in 40, which serves obviously more than one useful purpose. The cable is exposed. There is, of course, no need for a channel and slot, and this permits of a good and capacious grip. Cable sheaves are 30 feet apart in straight sections, and 8 to 9 feet on curves, and so arranged as to be clear the gripper. Cars weigh 9 tons, trailers weigh 5 tons. They are 40 feet long overall or 32 feet inside, and they seat 48 persons.

Trucks and frames are of steel. The engine—one suffices to run both tunnels, have cylinders 42 inches diameter, and 6 feet stroke. They are non-condensing and steam jacketed. The one engine indicates about 1,500 H.P. at 15 miles per hour. Across the house, capable of being driven by either engine, is a shaft, 18 inches to 21 inches diameter, carrying a 26-groove rope drum, 13 feet 9 inches diameter on each of its sections. These drums are driven through friction clutches of the annular multiple-plate type. These drums drive two 25 feet rope drums, each on a separate shaft. There are 26 2-inch cotton ropes, 15 driving one of the large drums and 11 driving the other, which is 18 feet in advance of the first. The cable drums are 14 feet diameter of differential Walker type with six grooves, to which the cables are suitably conducted, passing also round a 14 feet sheave on a tension carriage capable of taking up 300 feet of stretch. The cable itself is 1½ diameter, 36,300 feet long, of six strands of 13 to 16 wires, each on a hemp core. The lay of the wires and strands is in the same direction—called by some Lang's lay. The splices are 80 feet long. Each cable weighs 57 tons.

There are eight Lancashire boilers, 8 feet × 30 feet. Four to six only are ever used at one time. The regular pressure is 100 lbs. Each car sets its own signals as it enters and leaves a station thus notifying following cars. The system is thus an automatic block system. There is always kept a clear length of line. Two cars may not be at one time between two stations. Thus a 3½ minute headway is the closest possible, and must remain so unless intermediate mid-tunnel signals be allowed. Such is a brief *résumé* of a railway, in a progressive city like Glasgow, run upon a system declared in America to be now little other than historic. The line is said to pay and to be satisfactory.

It appears to have been well constructed, and whatever opinion may be formed of the cable system, it is certain to be in more or less competition with electrical lines, and as such should be critically studied by electrical men interested in the more approved system of electrical traction.

SOME NOTES ON THE ELECTRO-DEPOSITION OF CADMIUM AND ITS ALLOYS.

By SHERARD COWPER-COLES.

Cadmium, although in the past it has rendered valuable service to the chemist and metallurgist, its field for utility has been very limited, the total stock in London a few years ago amounting to comparatively only a few pounds. In colour and appearance it resembles tin, and melts at the same temperature as that metal, but when alloyed with 15 parts bismuth, 3 lead, 4 tin, and 3 parts cadmium, it melts at the remarkable temperature of 140° F., which is 72° below the boiling point of water. This peculiar property has led to cadmium being used for the manufacture of fusible wires for electric cut-outs.

The metal is found in the ores of zinc in small quantities not exceeding 2 or 3 per cent. Cadmium distils over in the first portion of the zinc during the distillation of that metal. A cadmium amalgam, consisting of 78·26 parts mercury, and 21·75 parts of cadmium, agreeing with the formula Hg_2Cd, can be kneaded like wax at a moderate temperature, and was formerly used by dentists for stopping teeth. Cadmium is very malleable and ductile at the ordinary temperature. The comparative hardness of electro-deposited cadmium to other deposited metals is shown in the following table:—

	Hardness.
Nickel electro-plate	10 0
Sheffield plate	10 0
Antimony electro-plate...	9 0
Palladium deposited bright	8 0
Chromium deposited on copper	7 0
Cadmium silver alloy Cd 60·5 Ag. 39 5 ...	5 0
Cadmium (deposited bright)	4 5
Silver (burnished)	4·0

The figures give the hardness as represented by the number of grammes weight on a diamond point required to produce scratch.

The electro-deposition of cadmium is, comparatively, readily carried out under the same conditions, as in the case of zinc. Borcher has found that current densities of 60 to 100 amperes per square metre (0·04 to 0·01 ampere per square inch), which gave an unsatisfactory deposit of zinc, are capable of yielding a good and useful deposit of cadmium.

Smee appears to have been one of the first, if not the first, to deposit cadmium. Since he published the results of his experiments the matter has received little attention, partly due, no doubt, to the scarcity and considerable cost of the metal at that time; it can now be obtained of good quality at a low rate.

Smee obtained tough deposits of cadmium from ammonia sulphate solutions, made by adding ammonia to the sulphate and dissolving the precipitate in a very small excess of the precipitant, but was unable to obtain good deposits from sulphate or chloride solutions.

In 1849, Messrs. Woolrich & Russell, of Birmingham, took out a patent for depositing cadmium; they prepared a solution by dissolving metallic cadmium in nitric acid of commerce, diluted to about six times its bulk with water at a temperature of about some 80° or 100° F., adding the diluted acid by degrees till the cadmium was dissolved. To this solution of cadmium they added a solution of carbonate of soda (made by dissolving 1 lb. of ordinary crystals in one gallon of water), until the cadmium was precipitated; the precipitate thus obtained was washed three or four times with tepid water, when it was ready for use, various solvents being used, but the one preferred was a solution of cyanide of cadmium, which was added in sufficient quantities to dissolve the precipitate and leave one-tenth of the solution in excess. The best working strength for the solution was found to be 6 ounces (troy) of the metal to the gallon, the temperature of the bath being about 80° or 100° F. Bertrand claims to have obtained white adherent coatings from an acid sulphate solution of the bromide slightly acidulated with sulphuric acid. A strong solution of the double salt of cyanide of cadmium and potassium is one of the best solutions, as it will deposit the metal rapidly and in a bright form, a cadmium anode dissolving very freely.

Its inertia to chemical action as compared to zinc and brass renders cadmium suitable for coating the terminals and connections of primary and secondary batteries, and for coating small shot (for sporting purposes) and steel bullet jackets, in the one case to prevent the leading of the barrels, and in the other the corrosion of the steel.

Cadmium has, of late years, been extensively deposited as an alloy with silver. It has been advanced, by those who view alloys as true chemical compounds, that the fact that certain of them can be deposited electrically lends countenance to their view. Seeing that brass was almost the only alloy which was successfully deposited, the position lacks strength from the scanty evidence supporting it, but lately alloys of various percentages of cadmium and silver have been deposited.

When attempts were made to roll an alloy containing 70 per cent. of cadmium, and 30 per cent. of silver into a sheet for the purpose of utilising it as an anode, it split up in an extraordinary way, having a remarkable structural formation as shown in the engraving, which clearly shows the cleavage planes.

Within the last three years cadmium silver alloys, containing but a small percentage of silver, have been employed for coating the bright steel parts of machines, such as bicycles, and a silver cadmium alloy, containing 7 5 per cent. of cadmium, has been somewhat extensively used for plating domestic articles. Such alloys have been found to withstand the tarnishing influences of the atmosphere much better than pure silver, or a standard silver containing 7·5 per cent. of copper.

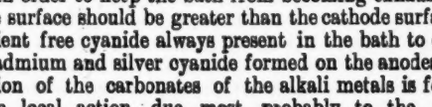
A silver cadmium alloy, upon being tested with a Thompson galvanometer, was found to be electro-positive to nickel, therefore, if the alloy is used for coating steel, and the underlying metal is at any time exposed to a chance scratch or abrasion, the corroding action of the air and water is more violent in the presence of the nickel than in the presence of the silver cadmium alloy covering, owing to a more intense electrical action being set up by the nickel.

A series of experiments has been made to ascertain whether an alloy of silver and cadmium forms a more effective

protective covering when applied to iron than is the case with nickel plating. A sample of nickel plated iron and a sample of iron coated with an alloy of cadmium and silver were subjected to different corroding influences. The nickel-plated iron in all cases rusted badly, in a very short time, whilst the samples of silver and cadmium coated iron were but little corroded, which was probably due to two facts. Firstly, the nickel plating being porous, permits the corroding action of the air and moisture to act on the underlying iron; this porosity appears to be almost entirely absent in the case of the silver cadmium coatings. Secondly, the silver cadmium coatings are found to be electro-positive as compared with nickel, there being a difference of more than ·25 volt; therefore, if the underlying iron is exposed at any time by a chance scratch or abrasion, the corroding action of the air and water is more violent in the presence of the nickel coating than in the case of a silver and cadmium coating, owing to the more intense electric action being set up by the nickel.

The process which has been largely used for depositing a cadmium silver alloy consists of preparing the electrolyte by dissolving the cyanides of the two metals in cyanide of potassium, the proportions of the two metals being varied with the nature of the deposit sought. To obtain deposits of 10 to 80 per cent. of cadmium, it is found necessary to have the ratio of the silver and cadmium in solution in the proportion of from 1 to 4 to 1 to 7, the best results being obtained when the amount of metal in solution is from 3 to 4 ounces per gallon, and the amount of silver per gallon not less than 8 dwts. or more than 25 dwts.; the weaker the solution the smaller must be the current density employed, and, in order to keep the bath from becoming exhausted, the anode surface should be greater than the cathode surface, and sufficient free cyanide always present in the bath to dissolve the cadmium and silver cyanide formed on the anodes. The addition of the carbonates of the alkali metals is found to reduce local action, due most probably to the nascent liberated metal. As the nature of the deposit varies with the current density, attention to the colour and general appearance of the deposit on a test plate is found to give full control over the composition of the alloy deposited; an experienced plater can judge the composition of the alloy within 1 per cent., which is found to be near enough for practical purposes.

The result of a large number of experiments shows that the minor differences between the two metals play a very important part. To start with, there is an E.M.F. between the two metals independent of the back E.M.F. of the whole electrolyte; further, a current that will deposit 402,418 grammes of silver will only deposit 2,079 grammes of cadmium, while there may be a considerable difference between the resistances of their respective salts in solution. If a bath be made up containing a certain number of ounces



of metal to the gallon, and deposits are to be obtained from different current densities, the percentage of silver obtained in the deposit will be different in nearly every case, and different for every solution. Consequently, it is only after much time and trouble and careful experiment, that the laws connecting the percentage of the deposit, composition, density of solution, and current density can be obtained.

The following remarks roughly indicate the laws governing the deposit of silver and cadmium; the experiments tend to show that the same remarks apply in greater or less degree in the deposition of other alloys. Solutions containing 2 or 3 ounces of metal per gallon and a large percentage of cadmium give, with small current densities (which alone are permissible), deposits varying from 40 to 100 per cent. of silver, whereas solutions containing 8 to 9 ounces of metal per gallon give 80 to 90 per cent. silver, for a very wide range of current density. For any given solution the percentage of the more electro-positive metal increases with the current density, but the variation is by no means in simple proportion. If the solution be a weak one, patchy deposits are the result of using too high current densities, the metals seem to separate out though the deposit may be smooth. The relations between the percentage of the more electro-negative and electro-positive metal at a given current density, can easily be varied if desired, by the simple process of stirring the solution. The movement of the cathode in the bath will temporarily alter the deposit, and if the bath is weak, and the anodes are not dissolving properly, it will greatly alter the resistance, and consequently the current density for the time being.

In short, it may be said that for every composition of the solutions there is a definite current density to be used to bring down a given deposit, and if the bath is to be maintained for any length of time in working condition, the deposit must be of the same composition as the anode. In order to check the working of such a bath, small platinum test-pieces should be employed, so that the composition of the deposit can be readily analysed. The ratio of the salts of cadmium and silver in solution is dependent on the density of the solution. If the solution is very dense, different proportions of cadmium and silver are necessary. It is, however, desirable to use a strong solution, because a much greater current density can be used, and consequently the alloy can be deposited much quicker. Stirring the solution permits the use of still higher current densities, but the proportions of silver and cadmium in the bath must be altered accordingly. To ensure an alloy of the desired proportions being deposited, it is essential to watch carefully the colour of the deposit as well as the current density.

CORRESPONDENCE.

The Position of Draughtsmen.

Your article points out pretty clearly the true position of draughtsmen. Their chances, looking at them from a prospective and remunerative point of view, dwindles into a vanishing point, and particularly in electrical engineering companies. For in those places he is ousted by the premium pupil who pays £300 for three years, when, in the majority of cases, the pupil gets a smattering of half a dozen branches of the business and does not know one thoroughly, and at the end of his time, some kind, influential friend comes along and gets the dear boy a comfortable job at a fair remuneration, where the best part of what he has to do is shown him. But the draughtsman may do his best and spend years in the drawing office, without any chance of promotion, or of getting out of it, and be looked down upon by his superiors, and be their tool for providing information.

There was, and is, a managing director of a well-known electrical engineering company who issued a type-written pamphlet to the draughtsmen in which he stated that they were necessary evils, very comforting.

There is a complaint that it is difficult to get good engineers nowadays, and that the present system of training is inefficient. If the matter were fairly investigated, it would, no doubt, be found, that the reliable and best men are those who have spent a good time in grinding out a few year's work in the drawing office.

The old type of engineer was of this order, namely, that if a man showed proficiency and ability in the drawing office he was promoted from there into a better position in the works, and they proved assiduous and good men. But the man who gets in the drawing office nowadays is practically doomed to get no further (for draughtsmen, as a rule, are not of the private income order to keep against their fate), and if he applies for a post in another branch of the business, and states in his testimonials that he has had good experience as a draughtsman, in nine cases out of ten, he is rejected, and so he seldom gets a chance of getting out of the rut, which is not his fault.

The pay of draughtsmen in electrical engineering is downright miserable, and his prospects doubly so. A cab-driver can do better, infinitely, though he be under police

supervision. To any man entering the engineering business, particularly electrical, one would say if you want to get on nowadays, keep clear of the drawing office.

A Fact.

THE LONDON UNITED TRAMWAYS AND ELECTRIC TRACTION.

Decision of the London County Council.

The expected debate on the application of the London United Tramways, Limited, to which reference was made in our last issue, took place at Tuesday's meeting of the County Council, when the Highways Committee submitted a fresh report on the subject. In this the Committee expressed the opinion that the Council might give provisional consent to application being made by the company for authority to use the overhead trolley system, but so far only as regards that part of the tramways between the Askew Arms public house and the Uxbridge Road railway station, and on condition that, in consideration of this concession, the company reconstructs, according to an underground system of electric traction, the other two lines of tramway specified in Mr. Robinson's letter. This arrangement, the Committee pointed out, would afford an opportunity for a full and satisfactory trial of both methods upon roads quite at the outskirts of the county, and the Council would be able to ascertain whether the overhead trolley system proves successful in the Uxbridge Road, and whether it is, or is not, a source of inconvenience, and also whether underground conduit and overhead trolley systems could be successfully worked, as the Committee had been assured they can, in conjunction with each other. The Committee accordingly recommended that Mr. Robinson should be informed that the Council would consent to an application being made to the Board of Trade for powers to reconstruct, on the trolley system, the tramways in that part of Uxbridge Road between the Askew Arms and the railway station, on condition that the company also reconstructed, according to an underground system, the tramways from Uxbridge Road railway station by Goldhawk Road to Young's Corner, and from Young's Corner to Hammersmith Broadway, and submit for approval full plans, details, and other particulars of the works.

The reception of the report was formally moved by Mr. Westacott, who observed that he would reserve his remarks for the present.

Mr. Strong stated that he was requested by the General Purposes Committee to move as an amendment that Mr. Robinson be informed "That the Council, whilst deeming it desirable to withhold consent to the introduction of the overhead trolley system until the Highways Committee has reported upon the subject generally, consents to application being made to the Board of Trade for power to reconstruct the tramways referred to in the letter on the conduit or other approved underground system." The speaker said the Committee were of opinion that it would be unwise to allow the trolley system until the promised report had been made.

Mr. Cornwall formally seconded the amendment.

Mr. T. B. Westacott, who regretted having to move the adoption of the recommendation of the Committee owing to the chairman (Mr. J. W. Benn) disagreeing with it, said the only question was as to whether the Council should allow two experiments to be made, or whether they should confine themselves to the conduit system. What the Highways Committee recommended was that the company should be permitted to instal the trolley system on one line if they would adopt the conduit method on the two others. The experiments would be carried out at the expense of the company, and members of the Council would be able to go and see for themselves which was the best and most useful for London. His friend, Mr. Baker, whose report on the subject had proved very valuable, favoured the idea of the conduit system, but the speaker had taken the trouble to ascertain which method was considered the best and most used. Thus he found that of the 204 tramways in Europe, 173 were arranged on the overhead system, and only 8 on the underground conduit. There was a great preponderance in favour of the trolley system, and the same condition of affairs prevailed in England, as, for instance, at Bristol, Leeds, Dover, Dublin, Cork, Wigan, Halifax, Glasgow, and other towns. The speaker then proceeded to quote from reports prepared on the subject at the instance of various municipal corporations, showing in favour of the trolley method.

Continuing, he said that they were told that the conduit system was far better, but it was curious that the deputations representing the corporations throughout England, after having seen the different systems in operation, had returned and introduced the trolley. Referring to the evidence given before the Joint Committee on Electric Powers in 1893, the speaker quoted Mr. R. E. Crompton as having said that he could not recommend the Buda-Pesth conduit system in this country, and that in nearly all large towns it would be impracticable to introduce it. All the Committee desired was for the Council to allow the two experiments to be made, and then it would be possible for them to see the lines in working order, so as to show which would be the best for the Council to adopt in developing the tramways of London.

Mr. Lawson contended that in one statement Mr. Westacott had given away the whole case. It was said that the Council ought to agree to the proposal of the company, because they would be afforded an experiment of value to the Council. He did not know that that part of London would be flattered by the decision of the Committee on that point. But the experiment was already about to be tried in Middlesex, where the company had obtained powers, and where the Council would be able to judge for itself. There was therefore no reason or argument in granting the privilege.

Mr. Verney rose and directed attention to the necessity, before accepting the overhead system, of being thoroughly convinced that it would not interfere with the fire escapes required for the safety of London.

Mr. Parker opposed the application on principle. It had always been a principle of the Highways Committee that overhead wires were a nuisance, and he thought that was the opinion of other municipalities. He recently visited Sheffield, where the poles were an abomination in the sight of the citizens.

The Earl of Onslow was surprised that the chairman of the Highways Committee had not moved the report, for it seemed to him that it was entirely in accordance with the views which he and Mr. Baker used to hold on the last Council. When the lease of the North Metropolitan Tramways Company was before the Committee, it was held by Messrs. Benn and Baker that some steps should be taken to test the practicability of electric traction for London. It was in deference to their views that a clause was inserted in the lease that the Council might experiment at the cost of the company in laying down a mile of electric tramway. The noble lord gathered that the particular scheme was to be rejected, because some members of the Council were of opinion that the trolley might be unsuitable for the streets of London. He was surprised to hear Mr. Lawson declare that the residents would not thank the Council for imposing the trolley upon them. What were the facts? They had a petition from the Vestry of Hammersmith asking the Council to permit the company to bring the trolley system within the boundaries of the county. If they were going to accept the principle that people were best able to manage their own local affairs, they could not oppose the clearly-expressed wish of the Hammersmith Vestry to have electric traction. If the Council declined to consent to the introduction desired by the company, there would only be one verdict—that it was entirely opposed to allowing any private company to introduce electric traction.

Mr. J. W. Benn said the noble lord had charged him with inconsistency in the matter. That was a very old question. The company had come before the Council on several occasions, the last time being in 1895, when the application was refused. The speaker then voted against the company's proposal, and had always done so. He was glad the responsibility for the clause in the North Metropolitan Company's lease had been placed upon him. With regard to the question of underground conduit or trolley, a committee of the Birmingham Corporation had come to the conclusion that the trolley must be kept out of the City, and the late Dr. Hopkinson agreed with the Committee as to the suitability of the conduit system for that city. If they were to develop the tramway property they must not add to existing difficulties by sanctioning arrangements of a trapeze order. The Council could get outside the county all it wanted.

Mr. Phillimore hoped the recommendation would be carried. It would be a great mistake for the Council to take up their stand upon the question and give a *non possumus* to the introduction of the trolley system in London. The method was undoubtedly more economical, and he trusted the Council would pass the report.

Earl Russell neither agreed with the resolution nor the amendment. Mr. Benn had taken up a logical stand against the introduction of the trolley system in London. The General Purposes Committee, however, were afraid to do that, but desired to postpone the consideration of the question until the Highways Committee had reported on what method was best for London. That might be some time yet. The Committee would have to proceed carefully, take expert advice and digest it, and come to a decision afterwards. The General Purposes Committee would postpone it to the Greek Kalends. The noble lord had not heard it said that the company were prepared to introduce the conduit system on condition of the trolley being sanctioned on one of the sections. It seemed to him that the Council were taking advantage of their statutory position that was never intended. The views of the Committee were a sort of compromise, and he ventured to assert that no recommendation would have been made had it not been for the *obiter dictum* of the House of Commons' Committee who considered the company's Bill. Earl Russell was in favour of the trolley system, which was suitable for the roads in that part of London, and he had not heard of any petition from residents asking the Council to decline to give consent to the application. What he would have liked was for permission to be given out and out; as it was, the Council would be charged with unreasonableness.

Mr. Beachcroft said that in 1895 he suggested, by amendment, that the company should be given permission to make the experiment. He wished now that that trial had been allowed. Members did not, perhaps, realise that the proposal would operate as a connection with the new Central London Railway, and would enable people to get right out into the country.

Messrs. McDougall, Gilbert, and others having spoken, the amendment was put, and lost by a large majority.

The original recommendation of the Committee was then put, with the following result:—

For the motion	41
Against the motion	19
Majority	22

The Chairman of the Council declared the recommendation of the Committee to be carried.

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BUSINESS NOTICES, &c.

Universal Electrical Directory (J. A. Berly's).—The 1899 edition is now in preparation. New names and corrections to existing entries should be sent in as early as possible. Copy and blocks for advertisements should also be sent forward to H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

Electrical Wares Exported.

Week Ending Oct. 18th, 1897.	£	s.	Week Ending Oct. 18th, 1898.	£	s.
Aden	21	0	Adelaide...	5,189	0
Alexandria. Teleg. mat.	25	0	Aden	900	0
Amsterdam	20	0	Alexandria	72	0
Auckland	137	0	Algoa Bay	149	0
Bilbao	30	0	Amsterdam	87	0
Bombay	331	0	Antwerp. Elec. fuse ...	551	0
Boston	15	0	Bombay	139	0
Calcutta	70	0	Boulogne	57	0
Cape Town	948	0	Brisbane...	77	0
Cologne	10	0	Buenos Ayres	288	0
Colombo...	80	0	Bushire	3	0
East London	26	0	Calcutta	13	0
Flushing	60	0	Cape Town	670	0
Gothenburg	240	0	Chinde	1,113	0
Hamburg	159	0	Copenhagen	45	0
Hobart	81	0	Delagoa Bay	225	0
Lisbon	111	0	Durban	182	0
Madeira	16	0	Fremantle	92	0
Madras	123	0	Ghent	83	0
Marseilles	450	0	Hamburg	400	0
Melbourne	830	0	Hong Kong	15	0
Montreal	40	0	Kobe	111	0
Ostend	30	0	Liban	87	0
Passages	197	0	Malta	75	0
Perth	13	0	Melbourne	220	0
Port Chalmers	543	0	Montreal	40	0
„ Elizabeth	192	0	Naples	26	0
Rosario	25	0	Port Elizabeth	183	0
Sydney. Teleg. mat. ...	11	0	Rio Janeiro	310	0
Timara	8	0	„ „ Teleg. mat.	44	0
Wellington	164	0	St. Petersburg. Teleph. mat.	40	0
			Shanghai. Teleg. cable	1,157	0
			Stockholm. Teleg. cable	716	0
			Spezzia	121	0
			Sydney	673	0
			„ Teleg. mat. ...	590	0
			Trieste. Teleg. mat. ...	20	0
			Wellington	132	0
			Yokohama	56	0
			„ Elec. cable	973	0
Total	£5,026	0	Total	£15,914	0

Foreign Goods Transhipped.

	£	s.	d.
Calcutta...	48	0	
Halifax	16	0	
Sydney	50	0	
Total	£114	0	

Alleged Fraud.—Ernest James Thomas, alias Ward Thomas, described as an electrical engineer, of Drayton House, Laira, has been remanded at Exmouth on charges of obtaining belting and electrical goods from many firms throughout England by false pretences. The case was, according to the *Western Morning News*, to come on for hearing on Wednesday, and has been taken up by the Public Prosecutor. Defendant, who formerly resided at Heavitree Bridge, Exeter, has for some time lived at Plymouth, and it is alleged that he obtained goods by falsely representing they were for a company. One note heading used was, "Waterside, entrance Commercial Wharf; stores, Commercial Road; from the Western Counties Electrical Company, Barbican, Plymouth, electrical and general engineers, telephone, marine engineers, sundrymen, and general agents." Another letter was on private notepaper, and headed "St. Jude's, Plymouth; at home 2 to 4." A third heading, "Drayton House, Laira, Plymouth." There is no such firm as "The Western Counties Electrical Company." As to "Drayton House, Laira," instead of that being a house of magnitude, it was a house poverty stricken and barely furnished.

Appointment.—Mr. Herbert E. McKiell (late London representative of Messrs. Johnson & Phillips), has been appointed London manager for Mr. I. Frankenburg, of the Greengate Rubber Cable Works, Salford, Manchester.

Agency Notice.—The Unbreakable Pulley and Mill-gearing Company, Limited, Manchester, have appointed Mr. F. J. Hill, engineer, 13, Bath Lane, Leicester, as their sole agent for Leicestershire, for the sale of their various manufactures.

Bankruptcy Proceedings.—The case of Edmond Savory D'Odiardi, medical electrician, Silver Street, Notting Hill Gate, came before Mr. Registrar Giffard, on Wednesday, in reference to the debtor's public examination. The receiving order was made last August on the petition of Miss Woods, who claims £150 for salary as nurse at a hospital originally styled the Electro-Pneumatic Hospital, but later known as the Notting Hill Gate Hospital. No accounts have been filed by the debtor, but a medical certificate was put in on his behalf, setting forth that he was too ill to attend for examination. Mr. Mellor, on behalf of creditors, stated that just after the action was brought by the petitioning creditor, the debtor executed a deed of trust covering his interest in the hospital, which was believed to have been carried on at a considerable profit. His Honour said the case certainly required investigation, and ordered the examination to stand over until the end of November.

The public examination of H. D. McIntyre, of Putney, Surrey, electrical engineer and colliery owner, was held at this month's sitting of the Carmarthenshire Bankruptcy Court, before Mr. Registrar Parkinson. The figures regarding the estate have already been given in the Electrical Review. Debtor's failure was due to insufficient capital and consequent loss in working, and to legal proceedings. The examination was adjourned to next month so that debtor might furnish a cost account.

The first meeting of creditors in *re* C. H. Kitching, plumber and electrical engineer, St. Hilda Street, Hull, will be held on October 21st, at 2.30 p.m., at the office of the Official Receiver, Trinity House Lane, Hull. The public examination is arranged for November 14th at 2 p.m., at the Court House, Town Hall.

Notice is given of an intended dividend in the failure of J. Fletcher and J. A. Hirst, Fletcher, Hirst & Co., electrical and mechanical engineers, Burnley. The last day for receiving proofs is October 26th. Mr. G. Proctor, 3, Grimshaw Street, Burnley, is acting as trustee.

Liquidation Notices.—At meetings of Rose & Bird, Ltd., held on August 26th and September 13th at 24, Stamford Street, S.E., it was resolved to wind up voluntarily, Mr. A. H. Rose, of that address, being appointed liquidator.

At meetings held at 3, St. Paul's Square, Bedford, on September 23rd and October 10th, it was resolved that the Bedford Electric Light Company, Limited, be wound up voluntarily, Mr. E. A. C. Rawlings, of the above address, being appointed liquidator.

The British Incandescent Electric Lamp Company, Limited, is to be wound up voluntarily, resolutions to this effect having been passed at meetings held at 2, Basinghall Avenue, E.C., on September 19th and October 14th. Mr. A. Riley, 21, Finsbury Pavement, E.C., is acting as liquidator.

Bridgewater Collieries.—In the large colliery district administered by the Bridgewater Trustees, it has been decided to re-model the entire telephone system, and Messrs. O'Gorman and Cozens-Hardy have been called upon to advise as to the most economical methods. The new locomotive and timber works on the estate are also to be made the centre for the distribution of energy for various purposes, the existing electrical plant being moved from one of the colliery pit mouths to the new works which are near at hand.

Changes of Address.—Messrs. Henry Greene & Sons, electric light engineers, have removed from 153, Cannon Street, E.C., to 19, Farringdon Road, E.C.

In consequence of the building of the new Government offices in Parliament Street, Great George Street, and King Street, Westminster, the following removals have taken place:—Mr. Thos. J. Rorke, electrical engineer, has removed from 17A, Great George Street, Westminster, to 5A, Jermyn Street. Messrs. Eastlakes, Limited, electrical engineers, have removed from 14, Parliament Street, S.W., to 5A, Cowley Street.

Messrs. Bullers, Limited, makers of telegraph insulators, are about to remove from 32-33, Queen Street, E.C., to 3, Laurence Pountney Hill, E.C.

Electric Elevator.—An Otis electric passenger elevator has just been erected in a block of very handsome new buildings in Lichfield Street, Wolverhampton, current being supplied from the Corporation mains.

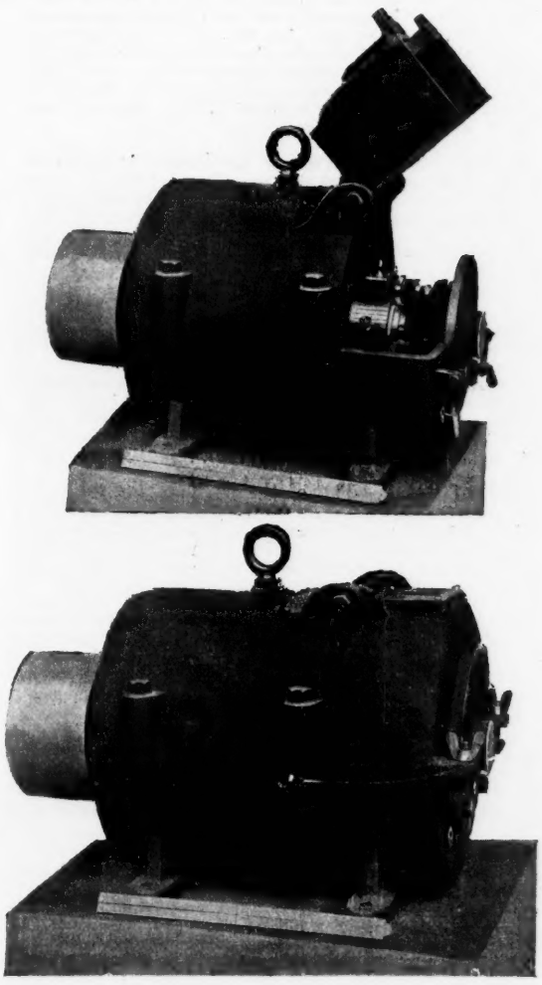
Electric Fire Alarms.—At the meeting of the Saffron Walden (Essex) Town Council on Friday last, it was decided to provide the Fire Brigade with an installation of electric call bells to the members and two telephones.

Electrical Work at Bristol.—Mr. Gilbert Lloyd, of Bristol, is busy upon a number of installations in the Bristol district. For the Western Counties Association he is putting in plant for arc and incandescent lighting at the new grain crushing mill; while at Messrs. Packham & Co.'s drapery establishment, 300 incandescent lamps are being fitted up, together with a number of Stewart arc lamps for outside lighting. A special plant is being installed upon Mr. L. Wansbrough's estate at Clifton. Mr. Lloyd is also engaged putting up a large telephone installation in Wiltshire.

Fire.—It is stated that a fire broke out on the premises of the Metropolitan Electric Supply Company, Limited, at Blackhorse Yard, Rathbone Place, Oxford Street, last Friday morning. The main switchboard suffered seriously. The outbreak was due to the fusing of a wire.

Hornsby Boilers.—The two Hornsby boilers which were supplied to the Charing Cross and Strand Electricity Supply Company's Lambeth Station, have worked so satisfactorily that six more similar boilers have been ordered. Two "Hornsby" boilers are also being erected at the Eastbourne Electric Light Company's station, where up to the present only boilers of the cylindrical internally fired tubular type have been used. Messrs. Hornsby have also secured the order for water-tube boilers for the Bexhill electric light station.

Enclosed Motors.—We illustrate below a new form of Messrs. Mavor & Coulson's enclosed type motor. The machine is bipolar with slotted drum armature. The bearings are self-oiling, and are mounted in flanged cases fixed to the motor shell by four



bolts. The flanged case, with the bearing, may be turned through 90° or 180°, so that the motor may be bolted to a wall or column or to the under side of a girder. The upper half of the shell, with magnet coil, is removable at the centre line, and, when raised, the armature is exposed for inspection throughout its length.

List.—Messrs. Webster, Michelson & Co., of Eve Hill Works, Dudley, have taken up the manufacture of copper gauze brushes, and are sending out a list of stock sizes and prices thereof.

The Midland Power Scheme.—A new map, showing the districts in which the Midland Electric Corporation for Power Distribution have obtained Parliamentary powers, has been issued. The districts include Heath Town, Wednesfield, Pulston, Short Heath, Willenhall, Darlaston, Wednesbury, Coseley, Sedgley, Tipton, and Rowley.

Monte Video Telephone Company.—A petition by the Monte Video Telephone Company, Limited and Reduced, for leave to reduce the capital of the company by £60,000, came on Wednesday before Mr. Justice Channell, sitting in the Chancery Division as Vacation Judge.—Mr. Alexander, Q.C., who appeared in support of the petition, said the Monte Video Telephone Company was incorporated in 1888, with an original capital of £180,000, divided into 24,000 preference shares of £5 each, and 12,000 ordinary shares of £1 each. A year after incorporation the company increased its capital by £40,000, divided into 5,000 preference shares and 3,000 ordinary shares, all of £5 each. Out of the 29,000 preference shares, 28,000 had been issued and fully paid up, and all the 15,000 ordinary shares authorised had been issued and paid up. It was now sought, with leave of the Court, to write off £60,000 of the capital, represented by £50,000 capital lost, and £10,000 assets which were not available. This it was proposed to do by dividing the existing £5 preference shares each into five separate shares of £1 value, of which three shares only would be preference shares, the remaining two shares being ordinary shares, and by reducing the £5 ordinary shares to £1 shares. In accordance with the articles of the company, meetings have been called of both preference and ordinary shareholders, at which the scheme was approved, and special resolutions were passed, and there was no opposition before the Court. Mr. Justice Channell made an order authorising the reduction of capital as proposed.

New Branches.—Messrs. Veritys, Limited, announce that they have opened a new branch at 55, Mitchell Street, Glasgow, for the convenience of their Scotch customers. All communications from firms in Scotland should be addressed to that office. The branch is under the charge of Mr. Sydney Andrews. For North of England clients, the head quarters are at 29, Princess Street, Manchester; the Midlands are served from their works at Aston; and the London district and the South of England are dealt with as heretofore from the London wholesale office at 31, King Street, Covent Garden.

Mr. James White, of Cambridge Street, Glasgow, informs us that for the convenience of his London clients he has opened a branch at 66, Victoria Street, Westminster, S.W., under the management of Mr. Patrick Hamilton, B.Sc., who has been with the firm at Glasgow for many years. At Victoria Street a display of Lord Kelvin's latest instruments for use in central stations and test rooms will be kept. We understand that the firm is exceedingly busy in its electrical department, and the works, which were extended a few years ago, are now running to their utmost capacity. At present over 300 hands are employed, and during the past two years many additional high-class machines have been installed enabling work to be done quickly and with accuracy.

Personal.—Mr. James L. Owen, C.E., M.I.E.E., M.E., has severed his connection with Messrs. Alfred Dickinson & Co., consulting, civil, mechanical and electrical engineers, and has taken offices at Temple Courts, Temple Row, Birmingham, for the purpose of practising as an engineer.

Telegraph Construction and Maintenance Company.—This company has decided to renew the debentures which mature on January 1st, 1899, for a further period of 10 years at 4 per cent. per annum. See our "Official Notices" for particulars of this announcement.

ELECTRIC LIGHTING NOTES.

Ashton-under-Lyne.—The Electricity Committee received 32 applications for the post of electrical engineer, and Mr. W. H. Vincent, of Woolwich, had been appointed.

Belfast.—The electric light accounts for the quarter ended September 30th, shows an increase in output of 55 per cent., and of 48 per cent. in actual rental, as compared with the corresponding period last year.

Incandescent electric lamps are to be tried for the purpose of experiment in Ann Street, Church Lane, Chichester Street, and Castle Street.

Bermondsey.—The dispute between the Vestry and the London Electric Supply Corporation, consequent upon the recent refusal of the former to sanction the laying of low pressure mains on both sides of certain thoroughfares has now reached a critical stage. This will be understood from the report submitted to the Vestry, at the meeting held on Monday evening, by Mr. T. Cox, chairman of the Electric Lighting Committee. The Committee stated that, in reply to the notification of disapproval, the company wrote, stating that, as soon as they received the approval of the County Council and the Postmaster-General, it was intended to proceed with the work as authorised by their Act. The Vestry clerk replied that he was not aware of any clause in the Confirmation Act of 1889 enabling the Corporation to proceed with works of which the Vestry disapproved, and pointed out that their procedure was governed by section 14 sub-section (c) of their order under which they had a right of appeal to the Board of Trade. The Corporation thereupon stated that they would appeal to the Board of Trade. In this connection the Committee mentioned that a communication had now been received from the Board of Trade, stating that they had appointed Major Cardew, R.E., to inquire into the matter of the appeal. The Committee had appointed the chairman (Mr. Cox), with Mr. F. Ryall, Vestry clerk, and Mr. Frank Sumner, the surveyor, to represent the Vestry at the inquiry. The Committee recommended, and the Vestry approved their action in the matter.

Bexley.—The Bexley District Council decided on Monday evening to oppose the application to the Board of Trade for powers to supply electricity within the districts of Bexley, Crayford, Erith, and Gravesend.

Blairgowrie.—Certain parties are said to have an electric lighting scheme for the town under consideration.

Bournemouth.—The electric light had an excellent advertisement on Sunday night. At about 7 o'clock the gas supply failed. The public streets and places of worship were thrown into darkness. Some parsons tried to hold their congregations together by their eloquence, and by otherwise continuing the services, but audiences rapidly dispersed. There are a number of churches lighted electrically from the mains of the Bournemouth and District Electric Supply Company, and, of course, these had a distinct advantage over the gas-lighted buildings.

Bristol.—On 18th inst. the Council resolved, upon the Electrical Committee's advice, to join hands with other municipalities, &c., in opposing the claims of Mr. Martin Rucker. The price for current is to be reduced from 6d. to 5d. for private consumers, owing to the success of the undertaking.

Bury St. Edmunds.—In our September 9th issue we stated that the Local Government Board had declined to sanction the proposed £20,000 electric lighting scheme. The Electric Lighting Committee has since drawn up a modified scheme—£16,000—but the Town Council is to send a deputation to the Local Government Board with a view to getting its sanction to the original scheme, as in its modified form there is so small a saving in the capital cost, and a very serious reduction in income.

Cardiff.—The Board of Guardians will call in an electrical expert to consult with the Building Committee and the architect, and report upon electric lighting for the workhouse buildings. Mr. Stephens, architect, recently submitted an estimate of £2,850 initial expenditure for electricity to be generated on the premises, with a maintenance of £350 per annum, as compared with £450 per annum for Corporation supply, and £370 per annum for gas.

Church Lighting.—The St. Hilda Parish Church, South Shields, is now lighted electrically, there being 146 16-C.P. lamps, or their equivalent, installed by Mr. James T. Dagleas. The nave of the church is lighted by six splendid wrought-iron corona fittings, hanging in the centre of the arches, along the front of the gallery. The back of the gallery is lit by single pendant lights with fancy shades. Underneath are three light wrought-iron electroliers. The massive candelabra has been adapted to the light, and fitted with large imitation candles, surmounted by spiral electrical incandescent lamps. The main switchboard comprises 24 switches. The song-room, vestries, belfry, and organ are all now lighted electrically.

Clontarf.—The Commissioners will hold a special meeting to consider the question of obtaining a provisional order for the electric lighting of the district.

Colchester.—At a recent Council meeting it was stated that as the result of communications with Messrs. Siemens Bros., it was thought best to have the inauguration ceremony a month after the date fixed for the Oyster Feast. The station buildings are completed, and the cables are nearly all laid, and some time in November current will be switched on.

Coventry.—In connection with the extension of the electric lighting scheme, four sub-stations are to be placed in certain parts of the town.

Crewe.—The Town Council, on 14th inst, put their seal to a contract for the purchase of a site for electricity works in connection with their £26,000 scheme.

Dorking.—The surveyor having reported upon the electricity works running in other towns of similar size to Dorking, he has been instructed to collect further details.

Driffield.—An electric lighting company is about to be formed, and in due course it is proposed to apply for a provisional order. The Urban Council has lately purchased the gasworks, and there may be opposition when the proposal develops.

Dundalk.—A special meeting of the Town Commissioners was held last week to consider the amended draft agreement between the Commissioners and the Tramway Company for the lighting of the town by electricity. At a conference between the Commissioners and a deputation representing the syndicate, most of the questions on which differences existed were settled by mutual concessions; but one clause on which the Commissioners insisted, the representatives of the syndicate declined to accept—a proviso that in the event of the light given by the 22 arc and 60 incandescent lamps not proving sufficient to light the town, as well as at present by gas, the company should provide such additional lamps as might be needed without extra cost to the board, the latter having agreed to raise the price of public lighting to £600 a year. This clause the Commissioners still adhered to, but a *modus vivendi* may possibly be provided by the additional clause inserted, that any dispute as to the guarantee clause or proviso should hereafter be referred to arbitrators mutually chosen by the Commissioners and the company. A resolution approving of the draft deed was adopted unanimously.

Edmonton.—The Board of Guardians on the 12th inst. resolved to light the Edmonton Workhouse with electricity.

Finchley.—The District Council will hold a special meeting to consider whether to apply for a provisional order.

Fleetwood.—The District Council is advising the Fleetwood Gas Company, Limited, that it intends to light the public street lamps and public buildings by electricity as soon as possible after the arrangements are completed.

Gosport.—The District Council at its meeting on 13th inst. received the following report:—"The Electric Lighting Committee, having considered the letters from the Electrical Power Distribution Company, and Mr. Madgen, one of the directors, having attended to answer any questions and to explain any details in connection therewith, beg to report that they are of opinion that the Council should retain in its own hands the power to supply electric lighting for the district, and they recommend the Council to oppose the application of the company for a provisional order, on the ground that they themselves intend to apply for an order."—The chairman, in moving the adoption of the report, which was agreed to without discussion, said that though the company had made the Council a very generous offer, it was felt that the matter, in its initial stages, ought to be kept in the hands of the Council.

Govan.—Glasgow has offered to supply Govan with the electric light at city rates, but the Govan Committee are inclined to lay down works of their own. Mr. Arnot, formerly engineer to the Glasgow Corporation Electricity Department, is advising the Committee. It has been ascertained that there would be a fair demand for the light from the very outset, and action will no doubt be taken shortly, either by accepting Glasgow's offer or proceeding with the erection of the necessary works.

Grays (Essex).—Several of the leading tradesmen have petitioned the members of the Grays Thurrock District Council to favourably consider the electric lighting question, which, they urge, will materially assist in the development of the town.

Greenock.—The Police Board last week, by 17 votes to 5, appointed Mr. S. E. Fedden, of the Edinburgh electrical engineer's department, resident electrical engineer for the borough.

Hampstead.—On Monday the Hampstead Vestry commenced the work of erecting the standards for carrying the electric arc light in Old Heath Street, Hampstead.

The Lighting Committee of the Hampstead Vestry has reported to that body: "That during the month of September 47 consumers' installations, with an equivalent of 2,840 8-C.P. lamps, were connected to the Vestry's electric mains, and that the total 8-C.P. lamp connections to the end of September were 71,367."

Hill of Beath.—Part of the profits of the public house, which was recently opened on the Gothenburg system at the village of Hill of Beath, near Dunfermline, have been applied towards the work of introducing the electric light. The engine and dynamo have been fitted up at the old Engine Pit. The engine is 20 H.P., and the dynamo is capable of supplying current for 200 16-C.P. lamps. Sixty lamps have been erected throughout the village. The light was turned on on Thursday, 13th inst. The installation has been carried through by Messrs. Hunter & Jack, Glasgow. There was a capital expenditure of £400, and the total annual expenditure for wages, &c., will be about £60. In connection with the ceremony of turning on the light, a meeting of the villagers was held in the village hall.

Hornsey.—The Hornsey District Council at Monday's meeting refused to join with the Finchley District Council in any further discussion with regard to the proposal of private companies to supply electrical power to combined districts, and also declined to discuss the matter with the Electrical Power Distribution Company.

Kidderminster.—The seal of the Council has been affixed to the agreement with the British Electric Traction Company for the sale of the Kidderminster Electric Lighting Order, 1891, to that company.

Lambeth.—The Lambeth Vestry last week again said much regarding the alleged "scandal" in connection with the transfer of the electric lighting order. The Local Government Board is unable to direct an inquiry to be held. The Vestry has, therefore, now appointed a Committee, consisting of one member from each ward, to inquire into and report upon the affair.

Lancaster.—The High Street Independent Chapel is going in for the electric light. The new Jubilee Palace of Varieties is also lighted with electricity.

Leamington.—Last week the Town Council decided to apply for a provisional electric lighting order.

Limehurst.—At last week's District Council meeting Councillor Lees reported the result of his visit to the conference of neighbouring authorities with Ashton on the electric lighting question. He said Ashton Corporation had stated that they were willing to place a Bill before Parliament to supply out-districts with electricity if a sufficient number of the neighbouring authorities were willing to take the electricity. The charge to the Council for the current would be 2d. per unit. After some discussion it was decided that the Council could not fall in with the proposal.

Llandudno.—It is expected that Mr. Chaplin, the President of the Local Government Board, will visit Llandudno, in order to inaugurate the electricity undertaking. Mr. Chaplin will fix the date. There will be a banquet at the Imperial Hotel.

Ludlow.—The Town Council has resolved upon an area of supply under the provisional order, which is to be secured. The capital outlay upon the scheme is put at £6,500. The Guildhall and Council Chamber will be lighted electrically.

Lye.—The Urban Council has directed the clerk to obtain information *re* electric lighting.

Maidstone.—The Urban District Council have not yet fixed upon a site for their proposed electric lighting works. The Committee is on the look out for one. Meanwhile the Council have entered into an arrangement with the gas company for a supply of incandescent burners to the whole of the street lamps for a year. It may be 18 months before an installation is carried out.

Lynn.—The following is a list of the tenders submitted in connection with the electric lighting scheme. The Council affixed its seal to the accepted contracts:—

Contract No. 1. Buildings, &c.:—

	£	s.	d.
1. H. G. Rudrum, King's Lynn	3,123	6	7
2. Foreman & Medwell, Lynn	3,097	19	5
3. Read, Wildbur & Co., Limited, Lynn	2,956	11	10
4. Merredew & Wort, Stevenage, Herts.	2,683	18	1

Contract No. 2. Gas-producing plant:—

1. Dowson Economic Gas Company, London	1,987	16	8
2. Tangyes, Limited, Birmingham	1,885	10	4
3. Paisley & Welch, London	1,602	6	4
4. Fielding & Platt, Gloucester	1,582	16	0

Contract No. 3. Gas engines:—

1. Tangyes, Limited, Birmingham	4,451	0	0
2. Andrew & Co., Stockport	3,373	3	4
3. Crossley Bros. & Co., Manchester	3,360	0	2
4. Premier Gas Engine Company, Nottingham	3,266	4	4
5. A. & W. Longsdon, Poole, Dorset (This tender is incomplete, as the travelling cranes are omitted.)	3,239	0	3
6. Fielding & Platt, Gloucester	3,237	16	0

Contract No. 4. Dynamos, switchboard, motor transformer, electrical instruments, fittings, &c.:—

1. J. H. Holmes & Co., Newcastle	3,326	8	0
2. Siemens Bros. & Co., Limited, London	3,103	7	4
3. The Brush Electrical Engineering Company, London	3,005	10	2
4. The Fuller-Westrom Electrical Manufacturing Company, London	2,909	18	6
5. Laing, Wharton & Down, London	2,781	9	8
6. General Electric Company, Limited, London	2,652	6	7
7. A. Penny & Co., London	2,379	3	6

Contract No. 5. Batteries:—

1. The Electrical Power Storage Company, Limited	1,090	2	7
2. Tudor Accumulator Company	1,033	4	6
3. Pritchetts & Gold	980	18	5
4. The Hart Secondary Battery Company	851	8	1
5. The Chloride Electrical Storage Syndicate, Limited	846	9	6

Contract No. 6. Armoured cables and other mains, pipes, stoneware culverts, fuse boxes, &c.:—

1. Dennis & Co. (for Felten & Guilleaume)	10,040	7	0
2. W. T. Henley's Telegraph Works Company	9,887	7	0
3. The British Insulated Wire Company	9,704	5	7
4. W. T. Glover & Co.	9,472	16	6
5. The Western Electric Company	9,182	12	6
6. Callenders Cable and Construction Company	8,880	14	1
7. Siemens Bros. & Co.	8,649	18	11

And it was agreed that the following tenders be accepted, but subject to the sanction of the required loan for the purpose by the Local Government Board:—As regards Contract No. 1, Messrs. Merredew and Wort, Stevenage; No. 2, Messrs. Fielding & Platt, Gloucester; No. 3, Messrs. Fielding & Platt, Gloucester; No. 4, General Electric Company, Limited, London; No. 5, The Chloride Electrical Storage Syndicate, Manchester; No. 6, Messrs. Siemens Bros. & Co., London.

In respect to the lamps, &c., Prof. Robinson stated that a separate contract would have to be made. He is to obtain tenders for them according to his designs submitted to the Council. A sub-committee will confer with Prof. Kennedy as to the positions of the lamps. Mr. Leigh Robinson, A.M.I.C.E., has been appointed engineer during the erection of the works. The Local Government Board has sanctioned the borrowing of £27,000, the actual cost of the scheme, but the £1,000 asked for wiring the municipal buildings the Board will only sanction under the provisions of the Municipal Corporation's Act, 1882, and a memorial duly sealed has to be furnished by the Corporation.

Monmouth.—The question of the appointment of an electrical engineer for the electricity works having been referred to Mr. Harris, the consulting engineer for the scheme, he advises that it is too early yet to appoint one. Messrs. Siemens's representative will be there for six or seven months yet, and Mr. Dean, who knew most about the undertaking, would be there for five months, so that no appointment need be made until Christmas.

Morecambe.—Mr. Parker (T. Parker, Limited) recently attended before the Electric Light Committee, and stated that the electric light works were now practically completed according to contract, and he asked for a certificate of completion, so that he could obtain the second 40 per cent. under the contract. Mr. Parkinson, the electrical engineer, mentioned that certain items were yet to be done before he could give a certificate that the works had been completed. He made out a list of the items, and Mr. Parker said that he would execute them within a fortnight. It was considered that inasmuch as the works had been running for six weeks Mr. Parkinson might grant a certificate of completion, except as regards the items specified, and which Mr. Parker said he would give a further guarantee to complete within a fortnight. Mr. Parker also said that the six months for maintenance should commence from the date of Mr. Parkinson's certificate. It was decided to call a special meeting of the Council to pass a cheque to Thos. Parker, Limited, for the 40 per cent. due upon the completion of the works.

Morgan.—At Morgan, Mid-Glamorgan, the Lighting Committee to the District Council have reported upon a scheme prepared by Mr. Smith, the architect, for lighting the district by electricity. He estimated the plant and cables at £1,000, and suggested that there should be 34 incandescent lamps of 54 C.P. at one point of the district and 70 incandescent lamps at another specified point. It was pointed out that in adopting the report the Council would not be binding themselves. The report was adopted.

Newington.—The Vestry has settled an agreement with the South London Electric Supply Corporation for taking from them electrical energy pending the opening of the Vestry's own station—up to a maximum of 100 kw., which is equal to 3,350 8-C.P. lamps.

Newport (Mon.).—At a recent meeting of the Electricity Sub-committee the consulting engineer (Mr. R. Hammond) attended, and reported on the progress that is being made with the extensions. It was reported that the emergency plant would be delivered in good time. With reference to the breakdown of one of the converters at the Town Hall sub-station, the borough electrical engineer reported that the converter in question had been forwarded to Messrs. Siemens for repair. The above report was adopted at a subsequent meeting of the Electricity Committee, which also considered tenders for the construction of three sub-stations. It was resolved that the tender of Mr. T. Westacott, at the sum of £272, be accepted. The office manager reported that the orders obtained for new connections were equivalent to 292 8-candle-power lamps, bringing the total number of lights, connected and on order, up to the equivalent of 20,021 8-candle-power lamps. The borough electrical engineer (Mr. C. D. Copland) submitted his report on the condition of the plant and machinery, which, with the exception of the defect in the condenser (which was receiving the attention of the manufacturers), was in a satisfactory working order. He also gave a comparison of the capacity of the plant with the number of lights connected. The capacity, exclusive of the reserve, is 300 kilowatts. The highest load yet reached was during the past month, viz., 293 kilowatts. It having been suggested that the question of charging consumers upon what is known as the Brighton system, necessitating the fixing of a "Wright's indicator" upon all the meters in use, should be considered, the members of the Committee are to be each furnished with a pamphlet explaining the system. The town clerk is to write to the contractors for the boilers and the laying of the cables, informing them that they will be held responsible for the loss or damage suffered by the Corporation consequent upon the delay in completion of their contracts. These various reports have been adopted by the Corporation.

Oxford.—During the past year the progress made by the Oxford Electric Company, Limited, has been greater than in any year previous, this being to some extent due to the public having availed themselves of the offer of the company to instal the houses and shops upon its mains with the necessary fittings, charging a small rental per annum for the use of the same. The number of lamps which have been added to the supply mains during the past year has been approximately equivalent to 4,000 8-C.P. About 30 new consumers in the residential district have been added, whilst installations have been made in Somerville College, Exeter College Chapel, St. Margaret's Hall, St. Mary's Hall, New College Tower, the President of Magdalen's House, Kettle Hall, the County Hall, Radcliffe Infirmary, and the churches of St. Peter-le-Bailey and St. Giles. The directors are contemplating a scheme for supplying the new district of Summertown. The whole of the distribution is now made from the Osney generating station, and two new boilers have been added to the company's plant to keep pace with the extra power required for supplying the additional lamps.

St. Pancras.—At Wednesday's Vestry meeting the Electric Lighting Committee announced the receipt of 15 tenders for the supply of coal to the electricity works in King's Road and Regent's Park, and the question will be brought before the Vestry at the next meeting.

Perth.—The Police Commissioners last week formally resolved to appoint Mr. W. C. C. Hawtayne as engineer to draw up a scheme for electric lighting, advise as to tenders, and to superintend the construction of the works.

Portsmouth.—At the last meeting of the Town Council the Electric Light Committee recommended that the whole of the electrical staff be insured at 12s. 6d. per cent. for workmen, and 3s. 6d. per cent. for clerical staff, to cover all risks, subject to the approval of the policy. Alderman G. Ellis, chairman of the Committee, in moving the adoption of the report, explained that this step had been taken because of the passing of the Workmen's Liability Act. The recommendation was adopted.

Redditch.—It is stated that the electricity works' buildings are nearly completed. The cables are being laid, and the foundations for the engines proceeded with. Some of the machinery was expected to arrive this week.

Rhondda Valley.—The Rhondda Valley District Council have taken exception to Messrs. Thomas & Evans, Porth, supplying electricity to two or three shops in that district without a license. The attention of the firm has been called to the matter, and they have now applied for and secured a license.

Rochester.—The Rochester Town Council last week approved of plans submitted by the Chatham, &c., Electric Lighting Company, of a proposed extension of their mains to London Road, Strood, and also on to Borstat, a town adjoining Rochester.

Rossendale Boroughs.—The question of electric light is before the three boroughs of Rossendale. Bacup Town Council, in consideration that they are already heavily weighted by the prospective cost of their new water scheme, seem to have pretty well made up their minds to transfer the powers to a company. At Haslingden they are talking of putting up a town's refuse destructor for generating steam cheaply to run the dynamos. Messrs. Lacey, Clirehugh & Sillar, have been appointed electrical engineers to Haslingden Corporation. Mr. Lacey has visited the town. He will hereafter report.

Rugby.—Last week the General Purposes Committee's proposals respecting area of supply were approved by the District Council. The Council's solicitor is to take the steps necessary to apply for a provisional order, and Parliamentary agents have been appointed.

Russia.—The central electric lighting station which is being erected in St. Petersburg by the Helios Company, of Ehrenfeld, Cologne, Germany, is rapidly approaching completion, and is to be put into operation on November 15th. Already applications have been received for a supply of current to over 30,000 lamps.

Salford.—The Corporation has appointed Mr. Charles Hopkinson consulting electrical engineer in succession to his brother, the late Dr. Hopkinson.

Salta.—According to a Buenos Ayres contemporary, the electric light station at Salta, which is now owned by the Bright Electric Light and Power Company, Limited, was inaugurated on September 10th. The Bishop blessed the undertaking, machinery, &c., and the usual champagne lunch was served.

Sheffield.—At last week's City Council meeting Alderman Clegg, at the instance of Mr. Senior, agreed to take back for further consideration the Tramway Committee's recommendation accepting the tender of Messrs. Scott Anderson & Beit for a combined engine and dynamo for lighting the power house at Kelham Island, at the price of £500.

Shoreditch.—The Lighting Committee reported to the Vestry on Tuesday evening that in consequence of the great demand for current at the present time, they had decided to insert notices in the local newspapers stating that from now no further application for electric current would be received except upon the understanding that the supply would not be required until after Christmas. It was resolved to issue advertisements inviting applications for the appointment of clerk of works in connection with the extension of the electricity works, the salary to be £3 3s. per week. The Lighting Committee further reported that Mr. Stallard had resigned his position as electrician-in-charge, and that they had instructed the chief electrical engineer to have the vacancy filled. The action of the Committee was approved. It was announced by the Officers Committee that consideration had been given to the application made by Mr. Newton Russell, chief electrical engineer, for an increase in his remuneration, he having completed two years' service. The Committee recommended that Mr. Russell's salary should be advanced from £250 to £350 per annum, with annual increments of £50 up to £500 per annum. The Vestry after considerable discussion adopted the recommendation.

Shrewsbury.—The Shrewsbury Corporation propose to purchase the undertaking of the Shropshire Electric Light and Power Company at a cost of £35,800, part of which is to be devoted to an extension of the works. Accordingly, on Friday last, Mr. W. A. Ducat, one of the inspectors of the Local Government Board, held an inquiry at Shrewsbury respecting an application by the Corporation for the necessary power to borrow the sum required. It was stated by the town clerk, Mr. H. C. Clarke, that the company obtained their powers in 1894, and that in 1897 they were approached by the Corporation with a view to the purchase of the works. Messrs. Kincaid, Waller & Manville were called in to value the works, and in February last a provisional arrangement was entered into with the company, the Corporation agreeing to pay £21,500 for the undertaking and goodwill. In case of the works being extended, which they would at once have to be if purchased by the Corporation, it would be necessary to acquire some additional property adjoining the present works, and for this purpose £800 would be needed. Since it became known, it was added, that the Corporation was likely to take over the works, the number of electric lamps had increased from 2,833 to 5,006, an increase of 2,173 in 12 months. This fact showed the public approved of the purchase. The sum to be paid the company was £21,500, besides which there would be the cost of other works which had been carried out since the provisional agreement was signed, and also the cost of extending the mains along Abbey Forgate, and to some other plans, and £3,000 was set down for contingencies. Evidence was given by Mr. Manville, who stated that the price to be paid was reasonable. Mr. Spearman (on behalf of the Shrewsbury Gas Company) cross-examined the witness at some length to show that the electric light company was working at a loss, and that the undertaking was not likely to prove of advantage to the ratepayers. It was certainly not, Mr. Manville said, a bankrupt property, but if secured by the Corporation, would soon be paying good interest. Mr. T. P. Deakin, chairman of the Lighting Committee, said the Council had been dissatisfied with the street lighting. They believed they could supply electric light and power much cheaper than any private company could do. There was no opposition but that of the gas company.

Southampton.—It will be remembered that some months ago the Town Council had a discussion whether the salary of its electrical engineer should be increased in view of his heavy duties. We referred to the treatment Mr. Lee received at their hands at the time. We do not say that this is directly connected with the present phase of matters, but Mr. Lee has accepted an appointment in London, and has resigned his position at Southampton. The Council is advertising at once for a successor at £250 per annum. When the matter was before the Council last week, Alderman Lemon said he had never known such extraordinary conduct in his life. Several councillors had practically driven an excellent officer away on the ground that he was too expensive, and now they wanted to appoint an engineer at an even greater salary. They were at present in a very nice plight, and he hoped this would be a lesson to the Council when they had a good officer to keep him.

Last week the Electric Lighting Committee stated that the electrical engineer reported that the number of units metered at the works during September was 18,860, an increase of 5,460, or 41 per cent. over the output for September, 1897. During the month existing customers had been connected up to the equivalent of 56 8-C.P. lamps, and one new customer, 48 of 8-C.P. lamps. He reported the receipt of an application for the supply of electric light to the new theatre, to the equivalent of 1,400 8-C.P. lamps.

Stirling.—The Lighting Committee had a conference with Prof. Kennedy on 30th ult., when certain details respecting the electric lighting scheme were considered. The system will be a continuous current direct supply at constant pressure on the three-wire system.

Sutton Coldfield.—The Corporation have filed notice in the *London Gazette* of their intention to apply for a provisional order for electric lighting.

Tunstall.—The Potteries Electric Traction Company having given the Urban District Council notice of an application for powers to enable them to light the town by electricity, the Highways and Building Committee recommended that, instead of allowing any company to obtain a monopoly, the Council should apply for a provisional order themselves.

Twickenham.—The clerk to the District Council has prepared an elaborate tabulated statement on electric lighting in the United Kingdom. He points out that a very large number of authorities who have obtained provisional orders are not seeking to use them; that in instances where public bodies themselves control the lighting, there are more losses shown than gains, and that where the lighting is in the hands of public companies, the gains predominate; but he admits the difficulty of judging accurately on the returns forwarded him, as the characteristics of each place would have to be taken into account. The report has been referred to the Special Lighting Committee.

Usk.—A £6,500 electric lighting scheme was brought up by the Public Lighting Committee at last week's Town Council meeting, but the question has been adjourned until the new Council meets.

West Middlesex.—There is every promise of a busy season in electric lighting in Central and Western Middlesex. The Twickenham District Council have been notified by two electrical supply companies of intention to apply to the Board of Trade for provisional orders to light the parish by electricity, and the Council themselves, whilst intimating that they will oppose both, have drawn up a report upon the subject, with a view to themselves obtaining a provisional order. At Hounslow, the Pioneer Electric Company have intimated that they will seek orders to light that district, and the Heston, Isleworth District Council on Tuesday decided that they should oppose, and at the same time refer the question of themselves lighting the district to a Special Committee. The same company have given the same information to Brentford, where the District Council having lately sanctioned the erection of a dust destructor, are about to acquire powers for lighting by electricity, using the heat from the destructor as a generator. At Teddington the Pioneer Company have given similar notice, and the local authority are disposed to follow the rule of surrounding authorities and control the electric supply themselves. In every case these local authorities hold the view that there must be large profits to be made, or public companies would not be so keenly in competition, and they desire the profits to go in aid of local taxation.

Weston-super-Mare.—The whole Council, in committee, has passed the following resolution:—"That, having regard to the resolutions passed at a largely attended meeting of ratepayers, held on September 22nd, it is desirable, if the necesary modifications can be mutually agreed upon, to accept the terms offered by the Electric Power Distribution Company for a lease of transfer of the Weston-super-Mare electric lighting order, and that a committee be appointed to give effect to this resolution, and to obtain such modifications of the company's offer as they may consider desirable in the interests of the town, and report to the Council at an early date."

Whitechapel.—The Electric Lighting Committee is to be allowed to expend a sum not exceeding £100 upon investigations now being made by the committee upon the subject of electric lighting and destructors.

Whitehaven.—The Congregational Church is to be lighted by 225 electric lamps, current being taken from the Corporation mains. There will be two electroliers, each with 25 32-C.P. lights, 26 16-C.P. pendants above and under the galleries, and a number of lights in the vestries, corridors, portico, &c. The work is being done by Messrs. Ramsay.

Yarmouth.—The quarterly report of the Electric Lighting Committee, presented last week, shows that the total number of customers was 299, for 13,829 lamps. The income was £1,156 4s., and the expenditure £614 17s. 2d. The Corporation thus earned £541 6s. 10d. over and above the cost of the production of the light in the three months when the consumption is least. For interest, repayment of capital charges, &c., the cost is about £570 a quarter. There has thus been a reduction of quarterly deficit to less than £30, and it is anticipated that in the future a considerable net profit will be made.

ELECTRIC TRACTION AND MOTIVE POWER NOTES.

Accrington.—The General Purposes Committee have passed a resolution favouring a system of electric traction for the trams, and recommending the Council to treat directly with the tramways company with that object.

Ayr.—A proposal has been made to run a light railway between this town and Monkton, and a sub-committee of the Works Committee has been appointed to report. The promoters are the Drake & Gorham Electric Power and Traction (Pioneer) Syndicate. Limited.

Bournemouth.—On Wednesday the Town Council discussed at some length a recommendation from the Roads Committee that the Corporation should apply for powers under the Light Railways Act to lay down and work tramlines in certain parts of the borough. The question has been repeatedly considered and always defeated, and on Wednesday the recommendation was thrown out by 10 votes to 6.

Bristol.—The plans of the extensive scheme of the Bristol Tramways and Carriage Company for the conversion of their horse system to electric traction are now before the city authorities, and when they have been approved work will be pushed on vigorously. Meanwhile the company is engaged making short sectional extensions and renewing certain portions of its track. The depôt at Horfield, to house between 30 and 40 cars, is nearly completed, and will be ready for use shortly. Additional property has been secured in Whitson Street, St. James's, where the present premises of the company are to be enlarged so as to hold about 40 cars, which will chiefly ply on the western section of the tramways system. The largest depôt of the company is to be constructed at Brislington, where operations are to be commenced immediately. Six acres of land in Sandy Lane have been secured, and upon this site are to be erected sheds to hold 100 cars. Those employed in the city proper are to be housed there, and the number being considerable, ample provision is to be made for them. A commencement has also been made on the power station at Counterslip, which is to be a huge establishment, and to be fitted up with the best possible electrical apparatus, and where also provision will probably be made for additional plant necessary to work other extensions which might hereafter be decided upon.

Buenos Ayres.—The City Councillors of Buenos Ayres are finally becoming tired of all the applications that are being made to them for concessions for electric tramways, and the *Review of the River Plate* says there is a tendency not to grant any more, but to call for tenders for their construction, and to sell the concessions to the highest bidder.

Carlisle.—The promoters of the Carlisle tramways scheme have written to the Town Council proposing to adopt the electric overhead traction system for the tramways as the simplest and most effective form of electric traction in use.

Coatbridge and Airdrie.—At Coatbridge Town Council meeting last week, the town clerk stated that in reply to his letter to the British Electric Traction Company, Limited, intimating that they were to oppose the scheme, he had received a reply, in which they said they were under the impression that the points raised in the town clerk's letter had been dealt with by the company's solicitor, but they now stated that they were quite agreed to adhere to the arrangement come to with the Light Railway Commissioners, namely, that half-mile stages and ½d. rates should be tried for two years, which was borne out by the terms of the Commissioners' report.

Dudley.—We understand that the draft agreement between the British Electric Traction Company and the Dudley Corporation for the equipment and working of the Dudley and Stourbridge line by the former has been signed. The company have already got that portion of the line that runs from Brierley Hill to Stourbridge well in hand, and electric cars will be running there by Christmas. The company are, we understand, in negotiation for the appropriation of the Dudley, Sedgley, and Wolverhampton line, and for the conversion of the steam traction into electric.

Gosport.—At the last meeting of the District Council, a letter was read from Mr. A. W. White, J.P., manager of the local tramways, in respect to the repair of the tramlines. He stated that the company could not entertain the request to relay the whole line, because a scheme was under consideration whereby he hoped Gosport would soon be in connection with Fareham and the villages in the neighbourhood. If it was decided to carry out the scheme the lines would have to be relaid for electrical traction. The chairman (Mr. G. Cooke, J.P.,) remarked that he hoped Mr. White would be able to run an electric service to Southampton, and so make local residents independent of the South-Western Railway. If this could be done it would be a great service to Gosport people.

Gravesend.—The Tradesmen's Association is suggesting to the Corporation the desirability of the electric trams being worked by the Corporation in the interests of the borough.

Hungary.—It is reported that the Hungarian State Railway authorities are about to carry out some trials with electric traction on the railway between Arad and Temesvar, a distance of 58 kilometres.

Hyde.—A dispute having arisen between the Corporation and the Oldham, Ashton-under-Lyne, and Hyde Electric Tramway Company, as to the laying of cables under the footpaths through the borough, to which the Hyde Town Council objected, Alderman Oldham, chairman of the Highways Committee, recently reported that the company had already taken up the footpaths, and in view of their action, he and the town clerk and the borough surveyor had had an interview with the permanent secretary of the Board of Trade, by whom they were informed that no new powers had been given to the tramway company, and that the matter in dispute was not one in respect of which the Board of Trade had jurisdiction. The Committee recommended that the opinion of counsel be taken as to the power of the tramway company to lay underground cables, and, if counsel so advised, an injunction restraining the company be applied for, or such other proceedings taken as counsel advised. The Committee's recommendations were confirmed by the Council last week.

Johnstone.—A motion is to be made by a Burgh Commissioner at the next meeting that:—"The Commissioners, while regretting the action of the Paisley Board in connection with the electric cars and Johnstone, should thank the Electric Traction Company and ask them to use every effort to get their car service brought to Johnstone, and that this Board do all in their power to aid them in doing so."

Kirkcaldy.—At a meeting of the Town Council last week the electric lighting and tramway question was again under consideration. It was explained that the Light Railway Commissioners had considered the tramways scheme too much of an urban proposal to fall under their jurisdiction. It was agreed to apply for a special Act of Parliament for powers to construct tramways, and to have a clause inserted giving them the option of handing the construction and working of the tramways to a company.

Leamington.—At last week's Council meeting a discussion took place on the proposal of the General Purposes Committee that the offer of the Warwick Town Council for a joint conference on the subject of the placing of overhead wires in the streets for the purposes of electric tram traction should not be entertained. Mr. Fell pointed out that if the Corporation agreed to meet the Warwick Town Council in the matter they would not in any way commit themselves to overhead wires, but merely to the discussion of what he regarded as a most important question. It was ultimately decided to refer the question back to the Committee.

Lowestoft.—Messrs. Seaton & Beer, of Westminster, have been laying before the Town Council a proposal to construct an East Anglian light electric railway extending from Caister, Yarmouth, to Southwold. The promoters would undertake to build a bridge across the harbour to take the cars. The Lowestoft Council has resolved to give its moral support to the scheme, and a committee has been appointed to conduct negotiations with the promoters, and to consider the terms of the application to the Light Railway Commissioners.

Manchester.—The Tramways Committee has been considering a preliminary report by its sub-committee on the tramway systems of several other towns. Dublin and Hamburg were visited, and the systems are reviewed. The sub-committee recommended prompt action on the part of the Manchester Corporation. The time is now at hand, they say, when the necessary borrowing powers must be obtained for the purchase of land, and the carrying out of necessary changes in the present tramlines so as to make them suitable for electric traction. As to the type of car to be adopted, the Committee report visits paid to Liverpool and elsewhere. In the former city it has been decided to adopt an American central-opening car of a single-deck pattern. The entrance thereto is from the left-hand side. The Committee summarise the arguments in favour of the single-decked and double-decked cars, and although the balance of favour appears to lie with the single-decked cars, the Committee state that their feeling is that the most satisfactory way of dealing with the question would be the adoption of double-decked cars on certain routes and single-decked cars on others. The Committee, the Council, and the public would then have full opportunity of judging of the merits and demerits of each type of car.

The Tramways Committee had the report before it on Monday and discussed it at considerable length, but its adoption was postponed until after further consideration, in order that additions may be made to its information and recommendations. The document will not come before the Council for approval until the January meeting. Details were concluded by the committee for promoting in the next session of Parliament a Bill to enable the Corporation to obtain powers to purchase the whole of the Manchester Carriage and Tramways Company's system of tramways within the city, and also powers to acquire the tramways in connection with the system outside the city by arrangements with the various local authorities through whose areas they pass, and to work the whole of these tramways. The committee will have to arrange for the obtaining of borrowing powers for the purchase of the system, and to provide the necessary equipment of rolling plant, and the erection of all necessary buildings for storing the vehicles. As to the electrical equipment, the question of borrowing powers will be left with the Electricity Committee, who will undertake the whole of the work relating thereto.

Newcastle.—At last week's Council meeting the Mayor proposed the inclusion of a clause in the Corporation Bill authorising the Corporation to acquire any lands or buildings necessary for

doubling the lines throughout the proposed tramway routes. Alderman Hamond objected, and said that this widening of roads and pulling down houses might cost the city £200,000. The town clerk said the Council had already decided that the lines should be double throughout, and the Board of Trade required a certain width for the other traffic. The clause was deferred.

Ramsey.—Lieutenant-Governor Lord Henniker has sanctioned the closing of the electric tramway to Ramsey during the winter season, owing to the necessity of constructing a double line near Ballaglass. The line has been phenomenally successful. On several days during the summer the company were unable to carry all the people who wished to travel. The Ramsey Town Commissioners met the directors last week with a view to having the promenade and town illuminated with electric lights.

Redditch.—The Redditch District Electric Traction Company, having applied to the Light Railway Commissioners for permission to construct an electrical tramway from Redditch to Astwood Bank, a distance of over three miles, an inquiry will be held at the District Council's offices on the 27th inst.

Southampton.—On Thursday last week a report was brought before the Southampton Town Council recommending the adoption of the overhead trolley system of electric tramways. In submitting the report, the chairman of the Tramways Committee said the scheme would cost in round figures about £40,000, but he was convinced a handsome profit would be secured on the capital employed. After some discussion, in the course of which objection was raised to the proposal on the ground that the overhead wire system would destroy the appearance of the streets, the report was adopted.

The report to the Tramway Committee by Messrs. Kincaid, Waller & Manville read as follows:—"We now beg to report to you as to the alterations required in the existing lines to fit them for electric traction. In dealing with this matter we assume that you intend adopting the system that experience has shown to be the most suitable for tramway electric traction. This system is that of suspending a conducting wire immediately over the tramways, upon brackets fixed on posts at the side of the roads. Other systems are in use at some few places, such as traction by accumulators, and the system of laying the conductor underground between the rails, but we do not think there is any reason why you should not adopt that which experience has shown to be the most efficient, viz., overhead conductors. In the following towns this system has been adopted, viz, Bradford, Bristol, Coventry, Dover, Dublin, Leeds, Liverpool, Middlesborough, Sheffield, Swansea, and several others, and, except on short lines at Blackpool and Birmingham, the other systems, we believe, have not been adopted in England. Both of these involve a larger expenditure than the overhead conductor system, and the latter lends itself more readily to the arrangements for the electric lighting of the streets. The necessity of utilising the rails as an efficient return conductor, so as to avoid any leakage or damage to the existing pipes, will involve the laying down of new rails in nearly the whole length of the tramways, and the placing of proper electrical bonds at the joints of the rails, and at the points and crossings. Before making a close estimate of the cost of this work, we should want your approval of the positions of double and single lines, and we also want your instructions as to the particular sort of paving to be laid down in the streets. To arrive, however, at an approximate result, we append the following particulars:—The existing line is laid over a route 4 miles 6 furlongs 9½ chains in length, consisting of 3 miles 5 furlongs 7 chains of single line, 1 mile 1 furlong 2½ chains of double line. This gives a total length of tramway of 6 miles 1½ chains. The additions we propose to make in doubling the existing line will increase the double line to 7 miles 4 furlongs 9 chains, and decrease the single line to 1 mile 4 furlongs 8½ chains, resulting in a total length of single line of tramway of 9 miles 1 furlong 7½ chains. The cost of laying new rails, properly bonded on this length of tramway, together with the fixing of the necessary posts and brackets and overhead conductors, will amount approximately to £2,632 per mile, equal to, say, £24,000. The cost of the necessary equipment will consist of 20 motor cars at £500, equal to £10,000, and alterations to depôt, say, £4,000, making a total of £38,000. We have not included in this estimate any alterations or additions which will be required at the generating station, nor the cost of the feeders for conveying the current to the trolley wire." The Tramways Committee, after conferring, recommended the Council to adopt electric traction for the tramways; also, by a majority of three, to adopt the overhead trolley system for the tramways in the borough; and further, that the scheme of tramways as indicated on the plan submitted by Mr. Kincaid be adopted, the remaining portion of this report being deferred for the present. This is the report which was adopted by the Corporation, as stated above.

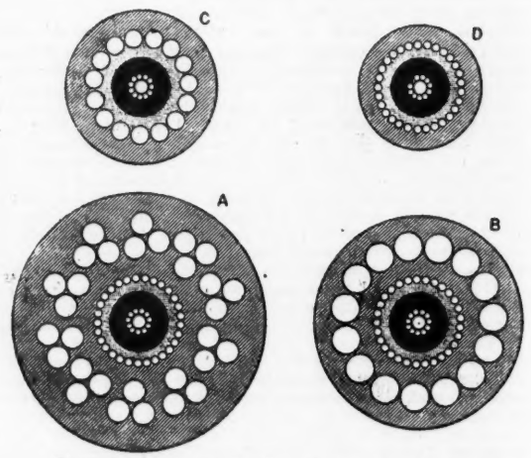
Twickenham.—A new proposal to construct an electric tramway, under the Light Railways Act, between Twickenham and Hounslow, by way of Whitton and Kneller Hall, was submitted to the Twickenham District Council on 13th inst. The matter was referred to a committee.

Watford.—The Urban Council had a discussion last week to decide whether they should support the proposed light electric railway for Watford and the contiguous districts. The voting for and against was equal, but the chairman gave his casting vote in favour, and the matter was adjourned until the next meeting.

Yarmouth.—The Corporation have decided to undertake a system of electric tramways for the borough. The subject was discussed last week, and the upshot of it is that a route is to be planned, and the necessary steps taken forthwith to obtain a confirmatory order during the ensuing session of Parliament. One member of the Council stated he was certain that as soon as the tramways were at work, profit would be made, and the rates reduced.

TELEGRAPH AND TELEPHONE NOTES.

The Brest-New York New Cable.—The *Electrical World* abstracts from *La Nature* the following data and illustrations of the cable which was recently laid direct from the coast of France to New York City by the French Telegraphic Cable Company:—The cable has a length of 5,700 kilometres (3,540 miles), and weighs in the neighbourhood of 9,250,000 kilograms (10,000 short tons) of which 5,500,000 kilograms represent the armouring of iron and steel, 930,000 the copper core, and 560,000 the gutta-percha insulating sheath. The conducting core is made up of a 13-wire copper cable, the central conductor having a diameter of 3·04 millimetres (0·12 of an inch) and the 12 strands surrounding it of



Cross-Sections of French Cable, Actual Size.

1·06 millimetres (0·04 of an inch). This conductor is surrounded by the gutta-percha dielectric, the thickness of which is 3·5 millimetres (0·14 of an inch), the weight of this material being about 180 kilograms (400 lbs.) per nautical mile. Outside of the copper and the gutta-percha, the dimensions of which are uniform throughout the length of the cable, the section differs according to the location. The protecting envelope is made up in four styles, shown respectively at A, B, C, and D of the illustration. The lightest section is that shown at D for deep-sea service, the armouring of which consists of 24 steel wires, each with a diameter of 2·29 millimetres (0·067 of an inch). In the intermediate type shown at C the steel wires have a diameter of 4·5 millimetres (0·13 of an inch). The coast type shown at B has double armouring, the strands of the inside protection being 24 in number, with a diameter of 2·29 millimetres (0·067 of an inch), and of the outside, 15 in number, with a diameter of 6·8 millimetres (0·20 of an inch), while the shore ends shown at A are also doubly protected, the inside armouring being the same as the last, and the outside made up of 10 three-wire strands, each wire of which is 5·6 millimetres (0·16 of an inch) in diameter. The cable is designed to transmit per minute 16 words of 15 impulses per word. The cable was manufactured and laid by La Société Industriale des Téléphones.

Glasgow Telephone.—The Telephone Committee has resolved, in view of the proposed municipal installation, to erect, as an experiment, an automatic switchboard in the Municipal Buildings for trial.

Manchester Telephones.—The Mutual Telephone Company has asked the Special Telephone Committee to support its application to the Postmaster-General for a municipal telephone license. The Committee has decided to interview the Postmaster-General to ascertain how the matter stands.

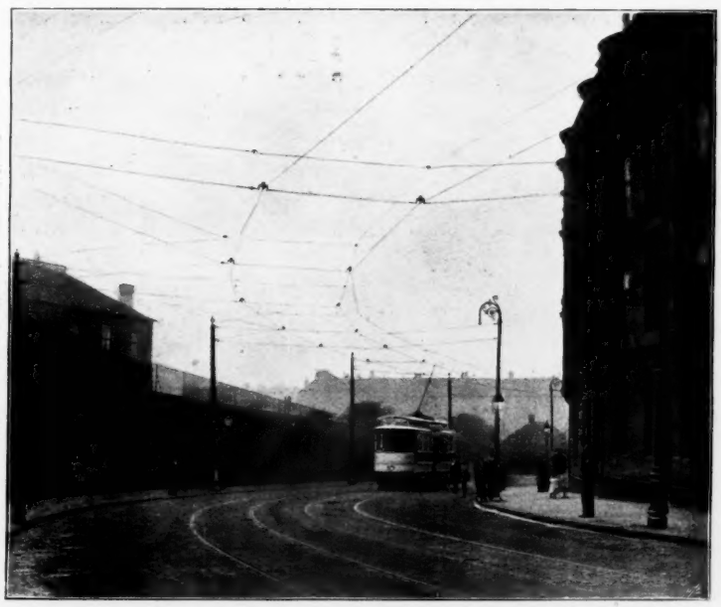
St. Pancras and the Telephone Company.—The telephone question was again brought forward at a meeting of the Vestry on Wednesday, consequent upon a recommendation submitted by Mr. W. T. Hawkin, chairman of the Highways Committee. The company sought permission to lay a branch line from Euston Road along Gower Street so as to connect the King's Cross exchange and that in the West End in order to improve the telephone service. Having fully considered the matter the committee recommended that as a recognition of the easement the application should be sanctioned on condition that the company would undertake to pay 1s. per 100 lineal yards of line per annum. Considerable opposition was manifested against the proposal, and in the end an amendment by Mr. Orange, suggesting that the report should be referred back to the committee, was carried by a large majority.

(*Continued on page* 601.)

THE GLASGOW MUNICIPAL ELECTRIC TRAMWAYS.

The interest evinced in the Glasgow electric tramways is quite disproportionate to the length of the line. The Scots are generally supposed to be a prudent nation, and a stranger to Glasgow might imagine that the short system of overhead line which has been erected between the centre of the town and a place named Springburn was merely to gain experience, and to ascertain whether or not the overhead system was what its advocates claimed it to be, or whether it had the objections so persistently urged by the gentleman with the studs. They may even tell you it is an experimental line, but the assertion should be taken with cold Scotch-caution, for no Town Council possesses a wider knowledge of the various systems of electric tramways at home and abroad. There is a story told that for some years the only deputations which visited the Continent were those which spoke German with a tartan accent, but obviously they must have come from the Highlands, because the only form of language used in Glasgow is Scotch, which, by the way, is no good for telephones, hence the troubles of the telephone system there.

A Section where Double Arm Brackets are Used.



A Sharp Curve.

Once Glasgow had an opportunity of becoming famous, but it bought 3,000 tram horses instead. Most of these, however, want repairing, and the northern city may redeem some of its tarnished reputation, as far as tramways are concerned, by declaring boldly for a great scheme of electrically-propelled tramcars. But we anticipate. Unfortunately, we must be historical, and although we are not going far back, it is well to mention some of the early incidents that have led up to the present Glasgow tramways. It is not necessary to say much of the days when tramways in Glasgow were operated by a company. Commencing in 1871, with a lease of 23 years, it was clear that little would be done by the company in adopting a system of mechanical traction, and in consequence of the result of elections in 1891, in which the tramways were made the test question, the Town Council resolved to take over the tramways on the expiry of the lease in 1894. When the Corporation took over the tramlines, it was with an entirely new plant. It had one weakness—horses were used — but the report of the first year's working demonstrating the complete success of municipal control, the question of mechanical traction was again brought forward, and the general manager, fortified by an investigation into American lines, strongly recommended the overhead system. This marked the beginning of a number of vexatious delays. A preliminary canter was made on the Continent in 1896 by a sub-committee of two, but this was merely to select a number of places for a larger sub-committee to visit. Still, after examining the systems in Brussels, Hanover, Hamburg, Berlin, Dresden, Buda-Pesth, Vienna, Milan, Genoa, and Paris, the conclusion set forth by the small committee was:—

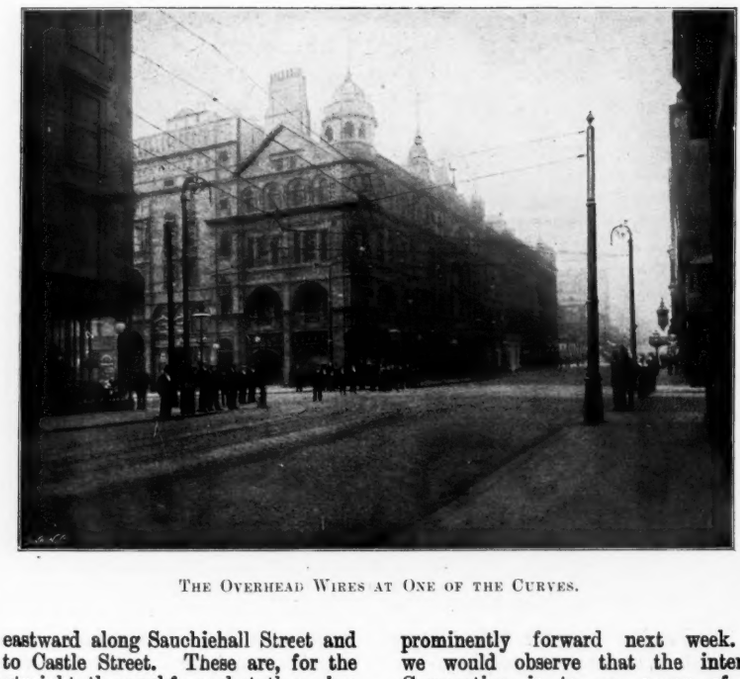
"That the overhead system of electric traction is the best we have seen, and can be made applicable to any part of the city." That, however, did not prevent the state visit of the sub-Committee to Brussels, Hamburg, Berlin, and Hanover, but they could do no more than the advance guard, for they reported: "That the overhead system is the simplest,

cheapest to construct and work, most accessible for maintenance and repair, and, on the whole, the most efficient system of mechanical traction which has yet been demonstrated by practical working." Such a clearly expressed opinion would have satisfied most municipalities, but was it sufficient for Glasgow? We trow not, for it was held that information was not complete, and Mr. Young, the manager of the tramways, and the engineer, Mr. Clark, were dispatched to America to investigate the latest systems. That visit served but to accentuate the previously expressed opinion, and seven months later—May, 1897—the Town Council decided to equip a short section of tramways with electrical plant. Then arose a pretty quarrel between the Lighting and Tramways Committee as to who should supply the current necessary to operate the tramways; the matter was even more vigorously contested than it was in Bristol, when the Corporation and the tramway company were the conflicting parties. Eventually the Lighting Committee capitulated, and the Tramways Committee were given permission to erect their own power house. As soon as the question reached the domain of the permanent officials, the practical stage was reached, and without any delay, specifications were accepted, and the construction of the line commenced. It was the completion of this which was duly honoured last week. Provosts and Bailies from higher and nether Scotland gathered to celebrate the inauguration of electric tramways in Caledonia. The event was worthy of the gathering, and of the luncheon, which Robert, in *Punch*, would have called a "bankwet."

Showing Posts Utilised for Arc Lamps.

To be merely descriptive, it may be said that the route which has been equipped for electric traction, commences in Mitchell Street, a short distance from the central station of the Caledonian Railway, and from St. Enoch station of the Glasgow and South-Western Railway. It extends up West Nile Street, turning eastward along Sauchiehall Street and Parliamentary Road to Castle Street. These are, for the most part, broad and straight thoroughfares, but there is a gradual ascent to nearly midway between the two ends of the line. Leaving Parliamentary Road the line curves northwards, and proceeds along Castle Street and Springburn Road, passing St. Rollox Chemical Works and skirting Sighthill Cemetery. Shortly afterwards it dives down under the low railway bridge of the Caledonian Railway line to St. Rollox Mineral Station. This railway bridge has proved a veritable thorn in the side of the designers of the electric tramway; it has happened in this wise. There were members of the Town Council who sought to have a trial made of cars with outside seats, but at the level of the road under the bridge alluded to, such a vehicle could not have passed with safety. Lowering the roadway was better than highering the bridge, so at this point the level of the road has been reduced some 18 inches; this has naturally increased the cost of constructing the road, but we can hardly credit the statement of a local scribe that this piece of engineering alone cost £3,000.

The car sheds and power house are about half a mile from the Springburn end of the line. The total length of the route is 2·40 miles, and there is a double set of rails throughout. Curves are fairly numerous, the sharpest one having a radius of 37 feet 6 inches. The overhead work, as will be gathered from the illustrations which we give herewith, is of a most interesting description. Some of it is not in accordance with English ideas, but it is probably no worse for that. Indeed, we hold it to be a remarkable example of the span wire system, and after a little time one begins to wonder why one thought bracket-arm suspension was the only method for this country. It is hardly necessary to point out that span wires are not exclusively used, for, as will be seen from the illustrations, one section of the route relies on centre poles with double arm brackets. The suspension of the trolley wire from these is different to English practice, but that arises mainly from the adoption of a rigid trolley pole. These are points, however, which we shall bring prominently forward next week. In the meantime, we would observe that the intention of the Glasgow Corporation is to use many of the posts for carrying arc lamps, and in many instances this has been carried out.



The Overhead Wires at One of the Curves.

(*To be continued.*)

EXPLOSION OF SUBMARINE MINES IN BALTIMORE HARBOUR.*

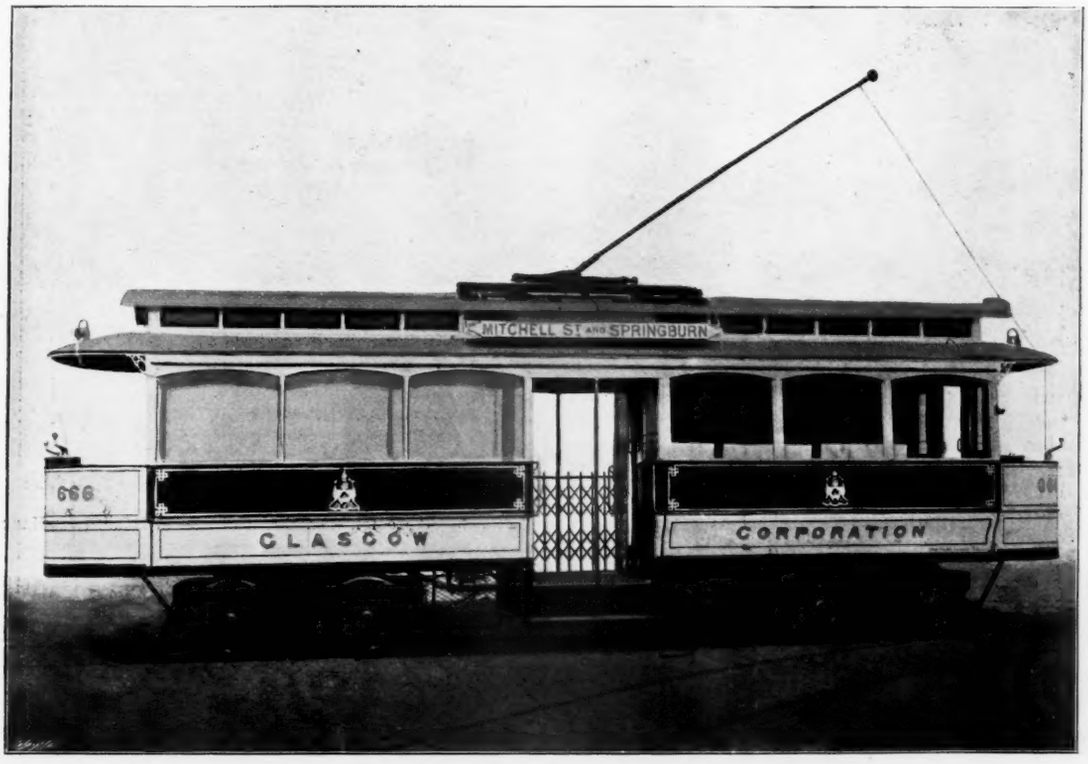
The naval operations of the late war with Spain have afforded another demonstration of the value of submarine mines as an element—we had almost said the chief element—of coast defence against an attacking fleet. Their value was abundantly proved during the blockade of Santiago, the actual objective of which was the capture or destruction of Cervera's squadron. From the day of their departure from the Cape Verde Islands to the fatal Sunday morning on which they were driven upon the Cuban coast, these cruisers and torpedo boats were the storm-centre of the war. No sooner had they cast anchor within Santiago Bay than our whole available naval force was concentrated at the entrance, in the expectation that the capture or destruction of these ships would probably mean the immediate close of the war—an expectation which proved to be remarkably correct.

It is not stretching the point too far to assert that if it had not been for a few sunken mines between Smith Cay and Morro, the army operations at Santiago would never have taken place. But for the existence of these mines, Admiral Sampson would have entered the bay, captured or sunk the Spanish ships, and confronted the city of Santiago with the alternative of capitulation or bombardment within a very few days after Cervera cast anchor in the harbour.

Apart from its enormous destructive power, the submarine mine exercises a powerful moral effect on the enemy, because of its invisibility and the practical impossibility of determining its exact location. It is the most quickly available of all systems of coast defence, and unlike all other means of defence, its cost is out of all proportion to the damage it can inflict. It is pre-eminently the weapon of the weak.

Submarine mines are of three different kinds:

1. Observation mines, otherwise known as judgment mines, which are fired by an operator on shore, when the hostile ship is judged to be within range.



A Single Deck Car on the Glasgow Municipal Tramways.

Cervera's fleet being definitely located at Santiago, it was to the obvious advantage of this country that the crisis should be reached at once; yet, as a matter of fact, the ships remained unmolested in the harbour for several weeks, and were only finally destroyed as the result of their own voluntary departure from the harbour.

What was it that prevented our fleet from entering the harbour, and necessitated the despatch of an army 20,000 strong to assist in the capture of the vessels? It was not the guns of Morro Castle, for these have proved to be old muzzle-loading weapons of very limited range and power, nor were the more modern guns on the opposite shores of the entrance sufficient to successfully resist a modern armoured fleet such as was drawn up at the mouth of the harbour. Our battleships and armoured cruisers could easily have forced the entrance if the nondescript batteries that guarded it had been the sole means of defence. It was known, however, throughout Sampson's fleet that the tortuous channel was sown with the deadly submarine mine, and the existence of these defences was sufficient to keep our powerful fleet outside during all the long weeks of the blockade.

* *Scientific American.*

2. Automatic mines, which are self-firing on being struck by the hull of a ship.

3. Electro-contact mines, which are electrically connected with the shore, and, on being struck, cause a bell to ring at the firing station, where the operator switches on the firing current or not, according as the vessel is a hostile or friendly ship.

The accompanying illustrations show the form of ground mine most commonly employed in this country. It consists of the mine proper, containing the explosive, which is placed on the bottom of the channel, and the electro-contact buoys, which are anchored above the mine at a predetermined depth below the surface of the water. The body of the mine is made of cast-iron. It is of a hemispherical shape, and is 4 feet in diameter and about 2 feet in height. The shell is 2 inches in thickness, and at the crown is a filling plug with electrical connections, over which is bolted a wrought-iron cap. The electric cable passes in through the clip shown on the side of the cap. The capacity of the mine herewith illustrated, which represents one of those which were used in the defence of Baltimore Harbour, is 250 lbs. of explosive. When it is to be used as an automatic or as an electro-contact mine, the floating buoy is attached to the ears of the cap.

The floating buoy is a hollow, buoyant sphere, in which is placed a circuit closer, and it is provided with wires which lead from the buoy to a fuse in the ground mine and to the signal station. The mechanism usually consists of a ball or a pendulum, which, on the buoy being struck by a passing vessel, swings into contact with a metallic ring and closes the circuit. If the mine is fully automatic or self-firing, the closing of the circuit sends a current directly through the ground mine and explodes it; but if it is to be fired from a station on shore, the circuit closer merely serves to give warning to the operator, who, by the throw of a switch, sends a powerful current through the mine and explodes it.

Our readers will remember that immediately upon the declaration of war the harbours of this country were planted

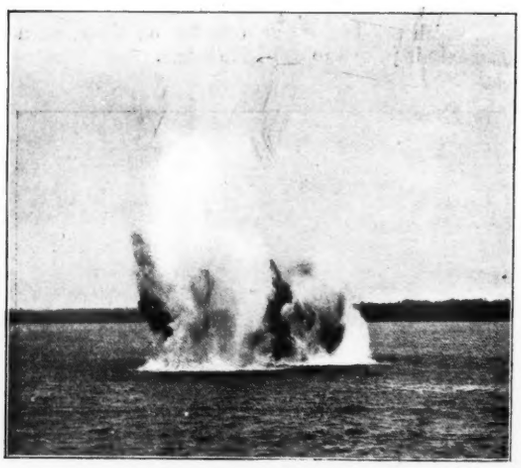
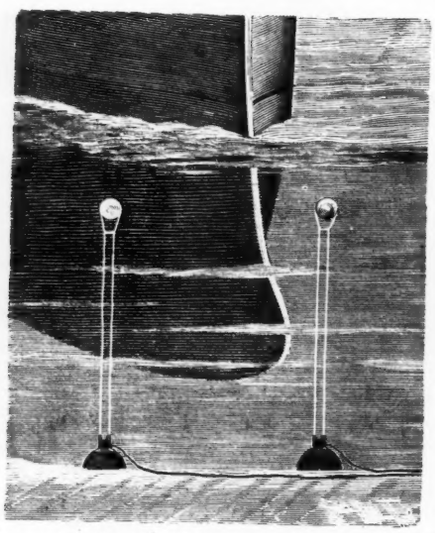


Fig. 1.—Explosion of a Group of Three Ground Mines in Baltimore Harbour.

with mines, which were maintained in working order until news came of the destruction of the Spanish fleet at Santiago. This occurrence and the overtures for peace on the part of the Spanish government led to the removal of these obstructions to navigation. In some cases the mines were removed, and in others they were exploded, in order to observe the



Submarine Mines in Place, with Electro-Contact Buoys Attached.

probable effect they would have upon a passing vessel. Those placed for the defence of Baltimore were all removed from the ship channel except one group of three, which was exploded on July 18th, with results as shown in fig. 1.

This group consisted of three mines, placed 100 feet apart, in a triangle, and connected with the firing casemate. They were each charged 225 to 250 lbs. of dynamite and were placed in 30½ feet of water; but as the bottom consisted of

Fig. 2.—Explosion of a Double Mine in Baltimore Harbour.

soft mud, it is likely that in course of time the mines settled considerably. The photograph was taken at a distance of 1,200 feet, and from a point 35 feet above the water. A

Charge, 225 to 250 lbs.

Submarine Mine of Type used for Defence of Harbours.

careful measurement by triangulation showed the column of water to be 225 feet high and the base of the disturbance 200 feet wide.

The other mines, which had been removed away from the channel and placed in water 22 feet deep, were exploded on August 27th, and the results photographed as before.

Fig. 2 was a double mine exploded at a distance of 500 feet. The base of the column was 100 feet wide and its height 246 feet.

In each explosion, except the first one, fragments of the cast-iron shell were thrown to a great height and some of them were recovered. The negatives made as the column of water was ascending show the iron fragments in their flight.

A study of these photographs will give a more vivid impression of the terrific energy of these machines than can be gathered from any verbal or written description. They fully justify the caution which prevents a naval commander from entering a harbour protected by mine fields until by countermining operations he has cleared the way for his fleet.

TELEGRAPH AND TELEPHONE NOTES.

(*Continued from page* 596.)

Misleading Information.—In the account of "Telegraphic communication between England and Australia," which is published in the widely circulated "Australian Handbook," we notice among other data given, a list of the cable sections, and in each case the number of cables connecting the stations which exist on the route between Australia and England. In all cases, with one exception, the number of cables between each pair of sections is given, but for some reason "Australia-Banjoewangie-Singapore," three stations are taken together, and the number of cables on the two sections thus taken together is given as three; the grouping in this instance has the effect of misleading those who may refer to the table for information concerning telegraph communication between Australasia and the rest of the world. It is, in fact, about as misleading as the evidence given before the Ottawa Conference by the Hon. Mr. Playford, Agent-General for South Australia, when speaking on the same subject. This gentleman is reported as saying: "And take the lines that we have from Australia at the present time; starting from Australia we have three cables, two from Port Darwin and one from Roebuck Bay. Go along further and you see four cables laid down. There is a multiplicity of cables; so that in no case between England and Australia are we at present dependent upon less than three cables." Misrepresentations and loose statements, similar to those above referred to, even although made in error, afford a basis which those interested in delaying the construction of a Pacific cable are not slow to turn to a use. We do not suppose that the editor of the "Australian Handbook" felt called upon to analyse the information given to him, as presumably the source from which it was derived may have seemed sufficient guarantee of its accuracy. The truth of the matter is, that there actually are three cables from Australia to Banjoewangie (in Java); but from Banjoewangie to Singapore there is only one cable, which was laid in 1879. That this single cable passing through a volcanic zone is one of the weak links in the lines uniting Australia with Europe is apparent, when we remember that, although it is more than 900 miles long, it lies in the shallow Java Sea, in a depth less than 50 fathoms, and averaging about 20 fathoms. When this cable was interrupted in September, 1897, all the Australasian traffic had to be carried on the Dutch landlines through Java, which worked badly. It is difficult to tell how long this cable was interrupted, as no notification of its breakdown or restoration was published by the Bureau International at Berne. We know, however, that it was interrupted for at least 10 days, and it is possible that there may also be other interruptions which have not been published from Berne. It may appear that we have dealt with this subject at too great a length, but as so many inaccuracies are being circulated here and in the Colonies regarding Australian cables, actual and prospective, we make no excuse for calling attention to the present case.

Proposed Addition to Australian Cables.—In the *Melbourne Argus* of the 6th ult. we find it stated that "in the event of the Australian subsidy (which was begun 20 years ago to secure a second cable between Java and Port Darwin) being guaranteed for another 20 years, a cable would be carried from Albany to Glenelg, in South Australia, and another from Port Darwin to Normanton to Cape York, to connect with the Queensland system, thus giving several alternative routes of tactical value." We have never been successful in understanding the theory indicated above. If cables, the property of the Eastern Extension Company, do not fulfil the conditions for which they are laid, it would seem only businesslike that they should establish their cable system on a sound footing, and that without claiming assistance by subsidies, and nominally attaching such subsidy to any particular cable in their system. The connection by cable of Port Darwin to the Queensland landlines will undoubtedly be of much value, and might economically be effected by the company, by picking up the cable which they laid from Java to Roebuck Bay in 1889, which is admitted to be of little use owing to the defective condition of the Western Australian landlines which join it at Roebuck Bay. This cable is about 900 miles long, and would go far to make up the total of the 1,400 miles of shallow water cable necessary to connect Port Darwin with Normanton and Cape York. The proposed shallow water prolongation (average depth about 20 fathoms) of the Port Darwin cables will probably not be very favourably received by the Governments of South and Western Australia, as it will undoubtedly result in a considerable diminution of the revenue which they at present derive from their landlines.

Proposed Reduction of Inter-Colonial Telegraph Rates in Australia.—We make the following extract from the *Melbourne Argus*:—"The anomalies in connection with the inter-colonial telegraph rates, brought under the notice of the Postmaster-General last week by the Chamber of Commerce, form the subject of a report by the Deputy-Postmaster-General, in which the whole subject is dealt with, and suggestions are made for the removal of the anomalies. With the aid of this report Mr. Duffy has drafted a scheme of rates which he intends to ask the other colonies, viz., Queensland, New South Wales, and South Australia, to adopt. The present rates are as follows:—From Victoria to Queensland, 3s. for 10 words; to New South Wales, 1s. for 10 words; and to South Australia, 2s. for 10 words. Although a 10-word telegram from Melbourne to Brisbane costs 3s., the same message by being sent first to Sydney and then to Brisbane costs only 2s. Another anomaly is the charge of 2d. per word made by New South Wales for all words over the first 10, for which the charge is 1s. Then it is anomalous that while a 10-word message to New South Wales costs 1s., a 10-word message to South Australia costs 2s. Mr. Duffy's proposal is that the rate to Queensland should be 2s. 3d., instead of 3s., of which Victoria would receive 9d., New South Wales, 9d., and Queensland, 9d; that the rate to South Australia should be 1s. 6d., instead of 2s., of which Victoria and South Australia would receive 9d. each; and that the charge to New South Wales for all words over the first 10 should be at the rate of 1d., instead of 2d. a word. It is estimated that these proposals, if accepted by the other colonies, will represent a loss of about £10,000 to this colony in the first year, but that the loss will disappear in the second year, owing to the increased business caused by the reductions."

Telegraphic Interruptions and Repairs:—

Cables.	Down.	Repaired.
Amazon Company's cable—		
Cable beyond Gurupa ...	June 8th, 1898 ...	...
St. Lucia-St. Vincent ...	Sept. 24th, 1898 ...	...
Bolama-Bissao	June 31st, 1898 ...	...
Perim-Assab	Sept. 13th, 1898 ...	Oct. 15th, 1898.
Gibraltar-Tanger	Oct. 18th, 1898 ...	...
Saint Louis du Senegal-Fernando de Novonha ...	Oct. 17th, 1898. ...	...
Pernambuco-Ceara	Oct. 19th, 1898. ...	...
Landlines.		
Majunga-Tananarive ...	Oct. 12th, 1898. ...	Oct. 12th, 1898.
" " ...	Oct. 17th, 1898 ...	Oct. 18th, 1898.
Saigon-Bangkok	Oct. 15th, 1898 ...	Oct. 16th, 1898.

Wooden Telegraph Poles.—The *Scientific American* says that an interesting experiment has just been started on the Philadelphia, Wilmington, and Baltimore Railroad in order to find out which is the best wood for telegraph poles. Some 42 have been set up in order to test the life of the various woods employed. These are six chestnut poles, creosoted; six pine poles, creosoted; six chestnut poles, woodilined; six set in broken rock, six in clay, six in the ordinary manner, and six to have a hole bored near the ground so that they can be saturated with oil.

York Telephones.—Before the York Chamber of Commerce, at Fossgate, on 11th inst., Mr. Dashwood Carter read a paper on "Improvements of the Trunk System of Telephonic Communication." The Chamber afterwards passed a resolution expressing the opinion that the telephonic system is inefficient, inadequate, and exorbitant, and favouring municipalisation and private company competition.

CONTRACTS OPEN AND CLOSED.

OPEN.

Belgium.—October 27th. The municipal authorities of Ghent are inviting tenders until October 27th for an installation of electric lighting in the new Flemish theatre in that town. Tenders to L'Hotel de Ville, Ghent, Belgium, from whence particulars may be obtained.

Bilston.—October 29th. Tenders are, according to an exchange, being invited for the construction of a line of telephonic communication between the Bilston waterworks pumping station at the Bratch and the Town Hall at Bilston, with the necessary receiving and transmitting instruments, and also the setting up of electric recording apparatus in the reservoir at Goldthorn Hill, with communication wires from the recording apparatus to the pumping station at the Bratch, and also to the Town Hall, Bilston, for the Bilston Urban District Council. Plans and specification, may be seen at the offices of Mr. Baldwin Latham, M.I.C.E., engineer for the works, 13, Victoria Street, Westminster, S.W., and also at the office of Mr. John D. Wassell, clerk, Town Hall, Bilston, and the form of tender may be obtained on application to the Engineer or to the Clerk, on deposit of £5, which will be returned to all persons making a *bona fide* tender.

Burton-on-Trent.—October 27th. The Corporation wants tenders for the supply, construction, and erection of a 250-kilowatt alternator and engine, complete with all accessories. Particulars from Mr. F. L. Ramsden, manager and engineer, Gas and Electric Light Works, Burton-upon-Trent.

Bury.—October 26th. The Corporation wants tenders for the wiring of the public baths, St. Marie's Place, Bury. See our "Official Notices" October 14th for further particulars.

Edinburgh.—November 14th. The Council want tenders for the supply of marine boilers and mechanical stokers and engines and dynamos for the electric light station in McDonald Road. Consulting engineer, Prof. A. B. W. Kennedy, 17, Victoria Street, S.W., at whose office specifications and drawings may be seen. See our "Official Notices" this week.

Edmonton.—October 25th. The Board of Guardians are inviting tenders for the supply and erection of engines and dynamos, condenser, pipe work, wiring for 600 lamps, switchboard, battery, &c. Particulars and specifications at the office of the solicitor and clerk. See our "Official Notices" October 14th.

France.—October 22nd. The French naval authorities in Paris are inviting tenders until the 22nd inst. for the supply of three steam dynamos giving 600 amperes at 82 volts, required in connection with the electrical installation on board the new cruiser *Henri IV.*

France.—October 27th. Tenders are being invited until the 27th inst. by the French post and telegraph authorities in Paris for the supply of 40 tons of high conductivity copper wire. Tenders to be sent to Le Sous-Secretariat d'Etat des Postes et des Telegraphes, 103, Rue de Grenelle, Paris, whence particulars may be obtained.

General Post Office.—October 25th. The G.P.O. is inviting tenders (*a*) for the supply of red fir telegraph poles, to be delivered in London, and at Northumberland Dock (River Tyne), West Hartlepool, Hull, or Grimsby; and (*b*) for creosoting the poles with 10 lbs. or 12 lbs. of creosote to the cubic foot, as may be directed. The poles to be felled during the winter of 1898-9. Forms of tender, containing all particulars, may be obtained on application to Mr. Chas. E. Stuart, controller of stores.

Ghent.—October 29th. The Ghent Municipal Council is inviting tenders for the installation of the electric light at a new theatre. The work, says *Daily Tenders and Contracts*, has to be completed by June 1st, 1899 (a fine being imposed for every additional day to completion), and maintained for 12 months. Labour clause. The contract includes the supply and delivery of 1,337 incandescent lamps, 20 arc lamps, &c. All expenses for registering, stamps, notices, &c., which are estimated to cost 130 francs, to be paid by the contractor. A deposit of 8,000 francs is required, on which 2 per cent. will be paid after 60 days. Specifications seen with, and plans obtained, on payment of 40 francs, from M. Le Sécrétaire Communal (A. De Bruycker), Gand, or at the office of the paper mentioned above. Tenders, on stamped paper, registered, addressed as directed, with a certificate of deposit, to be posted by October 27th. The tenders will be opened at 11 a.m. on October 29th.

Great Western Railway.—October 24th. The directors are inviting tenders for the supply of various stores for a year commencing December 1st, 1899. Among the items are telegraph instruments, apparatus, ironwork and tools, and drysalteries; copper wire, G.P. wire, &c.; electric light carbons, and incandescent lamps; telegraph poles, &c., &c. Specifications, &c., from the offices of the Stores Superintendent, Swindon. For further particulars see our "Official Notices" October 7th.

Halifax.—October 25th. The Board of Guardians is inviting tenders for supplying and fixing at the new union hospital, Skircoat, Halifax, about 85 small electrical ventilating fans, for the Guardians. Specifications and particulars from Messrs. Shepherd and Watney, consulting engineers, 71, Albion Street, Leeds.

Hanley.—November 14th. The Corporation is inviting tenders for the erection of a refuse destructor. Particulars from Mr. J. Lobley, borough engineer.

Harrogate.—The Corporation wants tenders for the supply of 18 cast-iron arc lamp poles, 18 feet long above ground, fitted with Hyde Park carriers. Borough electrical engineer, Mr. Geo. Wilkinson. See our "Official Notices" this week for particulars.

Kingston-upon-Hull.—October 27th. The Electric Lighting Committee invites tenders for the supply and erection of certain plant in connection with the electricity works, including high and low tension mains, casings, trench work, &c.; switchboard, continuous current rotary transformers, motor-generator, &c.; centrifugal pump, condenser (ejector type), steam pipes, &c. Electrical engineer, Mr. A. S. Barnard. See our "Official Notices" September 23rd for particulars.

Morecambe.—October 31st. The Electric Lighting Committee is inviting tenders for Lancashire boiler, continuous current steam dynamo (180 kw.), two 40-kw. transformers, switch panels, switches, &c. Electrical engineer, Mr. C. F. Parkinson. See our "Official Notices" this week for details.

Morley.—October 31st. The Morley Industrial Co-operative Society is inviting tenders for the wiring, &c., of its new buildings in Queen Street. Particulars from the office up to to-morrow, Saturday.

The Potteries.—October 22nd. The British Electric Traction Company, Limited, is inviting tenders for the overhead construction of the Potteries Extension Tramways. Specifications and particulars may be obtained from Mr. C. H. Gadsby, contract engineer to the company, at the company's offices, on deposit of £5 per set.

Shoreditch.—October 26th. Tenders are invited by the Vestry for the supply of one 10-H.P. electric motor. Specification, &c., from the surveyor, 287, Kingsland Road, N.E. See our "Official Notices" this week.

Southampton.—November 16th. The Committee of Visitors of the County Lunatic Asylum, Knowle, near Fareham, is inviting tenders for the supply of two engines and dynamos equal to an output of 24,000 watts each, together with all necessary washing machinery, lathe, drill, motors, lamp installations, &c., required in connection with the centralisation and increase of the light, heat, and power generating plant. See our "Official Notices" October 7th *re* specifications, plans, &c.

Toronto (Canada).—November 9th. The Toronto Board of Control is, according to *Daily Tenders and Contracts*, inviting tenders for a complete installation of electric lighting plant. Tenders will also be received for the various portions of the work, viz.: 1. Engine equipment. 2. Countershafts and pulleys. 3. Belting. 4. Boilers. 5. Feed pumps and condensers. 6. Water and steam piping. 7. Economisers. 8. Dynamos and station electrical apparatus. 9. Arc lamps. 10. Mast arms and lamp attachments. 11. Poles and overhead circuits. 12. Conduits and cables. Plans and specifications seen, and forms of tender obtained, at the office of the City Engineer, Toronto. The specifications for items Nos. 2, 3, 5, 6, and 7 may be withheld until the remainder of the apparatus is decided upon. A deposit in the form of a marked cheque, payable to the order of the City Treasurer, to the amount of 2½ per cent. of the value of the work tendered upon, must accompany each tender. Tenders, bearing the *bonâ fide* signatures of the contractor and his sureties, to the Chairman of the Board of Control, City Hall, Toronto, Canada, by noon on November 9th.

Wimbledon.—November 7th. The District Council is inviting tenders for the supply, delivery, and erection of transformers and accessories. Specifications, &c., from Mr. A. H. Preece, 39, Victoria Street, S.W. See our "Official Notices" October 14th.

CLOSED.

Buxton.—The following tenders have been accepted in connection with Prof. Kennedy's electric lighting scheme:—1. Boilers.—Messrs. R. Hornsby & Sons, £1,659. Time of delivery, 20 weeks; 2. Electrical plant.—Messrs. Mather & Platt, Limited, including spare parts, and compound steam pumps, £4,236 (28 weeks); 3. Battery.—Tudor Accumulator Company, Limited, £820. Annual charge for maintenance, £52 (10 weeks); 4. Switchboard.—James White, Glasgow, £1,353 (16 weeks); 5. Steam exhaust and other pipes.—John Spencer, Limited, Wednesbury, £950 (21 weeks).

Kennington.—The following tenders have been received for the electric lighting of the Princess of Wales's Theatre, Kennington. Messrs. Owen Lucas & Pyke are the consulting engineers:—

Pritchetts & Gold	£12,469 15
H. G. Ellis & Co., Limited	11,989 5
F. Suter & Co.	11,166 6
Foote & Milne	9,924 15
Marryat & Place	9,811 15
Speedy, Congdon & Co.	9,283 15
Brush Electrical Engineering Company, Limited	9,129 15
S. H. Heywood	7,880 15
Sax, Slatter & Co.	7,789 13
Hampton & Sons, Limited	7,508 15
Calvert & Co.	7,246 15
Strode & Co.	5,979 15
John Bolding & Sons	5,931 15
T. H. Taylor	5,617 7
Laing, Wharton & Down	5,459 0
*Barclay & Son	5,464 15
A. Penney & Co.	5,233 17

* Accepted subject to slight modifications in specification and price.

Liverpool.—It is stated that the Liverpool Corporation has placed the contract for 14 steel Lancashire boilers for the electricity station at Pumpfields, Vauxhall Road, with Messrs. Tetlow Bros., of Holinwood, at £656 each.

Lynn.—Particulars of the accepted tenders for the Council's electric lighting scheme will be found among our "Electric Lighting Notes."

Stockport.—The Gas and Electric Lighting Committee has considered samples of meters from the following firms:—Ferranti & Co., Thomson-Houston Company, and Chamberlain and Hookham, and has resolved that Messrs. Ferranti & Co.'s tender to supply 50 meters, at £5 5s. each (within 12 months), be accepted.

Tynemouth.—At last week's Council meeting Ald. Green brought up the report of the Trade and Commerce Committee, which recommended the acceptance of Messrs. Holmes & Co.'s tender for engines and dynamos at £4,100 in connection with the new electric lighting installation, and that of Messrs. Siemens Bros. & Co. for balancers and boosters at £549.

FORTHCOMING EVENTS.

Friday, October 21st.—At 8 p.m. Electro-Harmonic Concert. At 8 p.m. Institution of Junior Engineers. Presidential address by Sir W. H. White, K.C.B.

Saturday, October 22nd.—Manchester Association of Engineers, Grand Hotel, Manchester. Paper by Mr. Henry Hodgson, on "Some Points in Modern Steam Engine Practice."

Monday, October 24th.—At 3.30 p.m. Opening of the Corporation new electric lighting extension works, Sculcoates Lane, Hull, by Councillor J. T. Skinner.

Tuesday, October 25th.—At 8 p.m. Northern Society of Electrical Engineers, Grand Hotel, Manchester. Address by the president, Mr. J. S. Raworth, to inaugurate the session. Subject: "The Rapid Development of Electrical Engineering during the Present Year."

Friday, October 28th.—At 5 p.m. Physical Society, at the rooms of the Chemical Society, Burlington House. Agenda: (1) "An Influence Machine," by W. R. Pidgeon, M.A.; (2) "The Repetition of an Experiment on the Magneto-optic Phenomenon discovered by Righi," by Prof. Silvanus P. Thompson, F.R.S. (3) "The Magnetic Fluxes in Meters and other Electrical Instruments," by Albert Campbell, B.A.

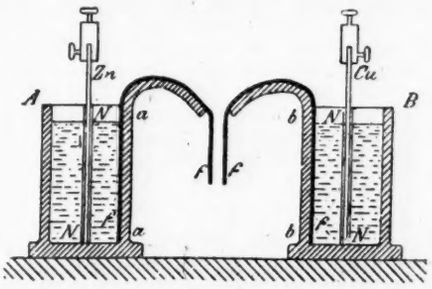
NOTES.

Boiler Room Economy.—In a paper by Mr. Moseley, read before the Canadian Association of Stationary Engineers, figures were presented to show that the mean difference between ordinary and competitive firing is 10 per cent. In tests with a Jones mechanical stoker, it was shown that this stoker did 50 per cent. more work at a 25 per cent. better economy when compared with ordinary hand firing, but that in a competitive test its superiority was 25 and 15 per cent. respectively. It is practically impossible to continue to fire as at a short period of competition, and probably this has much to do with the success of mechanical stoking, the machine, if kept in order, not getting tired or losing interest. The author advocates paying a fireman as a skilled man, not as a mere labourer, and thinks that a cut-down in his wages would show a fourfold increase in fuel, each dollar of reduction meaning another four dollars of coal. It is so obviously impossible to keep up to highest efficiency for long at a time, that there ought to be a premium system of paying stokers on the basis of evaporation per ton of coal, or of percentage of CO_2 in the flue gases. The latter is the better, because by the former method there is more or less temptation to waste at the blow-out.

Testing Furnace Circularity.—An instrument for testing the circularity of furnaces was recently described by Mr. T. Messenger before the North-East Coast of Engineers. It is very simple. A set of three radial legs pointed at the outer end is placed in the furnace to be tested, and caused to grip the furnace, the three points moving outwards simultaneously by means of toothed quadrants. The points carry at their central point a trammel bar with an end roller and a pencil. The arm is revolved in the furnace, and the pencil describes a small closed curve on a paper. This small closed figure shows, by its departure from a true circle, the exact want of truth of the furnace. The effect is startling. If, in a 4-foot furnace, the circle of comparison is only 6 inches, the resulting closed figure appears very largely out of shape. The reason is, of course, that the actual departure from the true circle is shown, so that if a flue is half an inch out of truth, this half inch appears on even a 6-inch circle, and the proportion of deformation is exaggerated. This enables the true direction of the error to be more plainly determined when jacking back to true shape. The figures made by the instrument should be kept as records, and they will prove useful as comparisons from year to year as inspections are made. The instrument is very simple. By the use of different sets of points it can be used for any size of furnace, and it should prove most useful. The instrument is equally applicable to the gauging of steam engine cylinders, for which the roller may be replaced by a pointer, in order to obtain a trace of any scoring, which is so often present in a worn cylinder.

Automobile Trials.—From the *Journal of the Royal Agricultural Society* it appears that the results of the tests made near Birmingham in June last are very favourable to benzine motors. Taking benzine at 7½d. per gallon, as used in the Daimler vehicle, lamp oil at 4¾d. per gallon, as used in the Lancashire steam motor car, and coal at 20s. per ton, as used in the Chiswick vehicle, the cost per mile was only ½d. for the Daimler car, and it could have run 100 miles per day for 4s. and a man's wages. The fuel cost per total ton mile in the four cars was respectively 0·18d., 0·36d., 0·30d., while per cargo ton mile it was 0·465d., 0·774d., and 0·704d. From the early days of the present movement in automobile vehicles we have expressed our opinion in favour of the benzine car, as being the most free from complication. The Daimler car had four speeds, the Lancashire car had three, while the Chiswick company's car had only one speed, but could use boiler steam in its low pressure cylinder. The Daimler car had the least friction, and it made the highest mean speed. The tests are in direct contradiction to the dictum of Sir David Salomons, who expected most from steam cars, and his argument was correct; but so far the convenience of the benzine vehicle has enabled it to show the best results on all points. At present price alone seems to be a bar to a wider use of self-moving vehicles.

The Daniell as a Standard Cell.—Grotian describes in the *Elek. Zeit.* a modified form of the Daniell, which, though not so constant as the Clark and Weston cells, is yet sufficiently exact for most purposes, and is much more easily constructed. The arrangement is shown in the adjoining figure, where there are two retaining cells which are provided with a long lip on each side. One of these cells contains the zinc and its solution, while the other contains the copper and its solution. The plates should be held in the fixed vertical position, say, by means of grooves. The heavy black lines, *f f*, are pieces of filter paper, 2 or 3 inches in width, the ends hanging down over the ends of the lips, lower than the surface of the liquids. Each is first saturated



with its solution, then by capillary attraction the liquids will be drawn over slowly, and those that mix will drop, thus keeping the solutions pure. There should be five strips in the zinc solution and two strips in the copper solution. When in use the two overhanging parts of the strips are brought together, and pressed together by the fingers till they adhere. The copper plate should be coated electrolytically with pure copper, and the zinc plate should be amalgamated. The zinc solution should be 1·2 and the copper 1·1. A number of comparisons of this cell were made with a Clark which had been standardised by the Reichsanstalt, and the mean value of the E.M.F. was found to be 1·101. The resistance is several thousand ohms, and it will stand short circuiting. The E.M.F. rises slowly when the cell is not in use at the rate of 1 to 2 thousandths volt per 18 hours.

Lectures.—On 13th inst. Prof. A. Jamieson commenced a series of lectures on "Electric Railways and Tramways" at the Glasgow Technical College.

Before the South Staffordshire Institute of Mining Engineers, at Birmingham, on 17th inst., Mr. G. L. Addenbrooke read a paper on "Electric Power Distribution: The Project of the Midland Electric Corporation and its Bearings on the Mining in the District."

More Trade Unionism.—There has been trouble at Bethnal Green in connection with a contract for electric wiring, certain workmen employed by one contractor apparently refusing to continue work unless the men of another contractor joined certain trades unions. It would appear that if in the pursuit of his wire laying a wireman needs to put a hole through a wall, or remove even an odd brick, he must loaf about until it please some bricklaying monopolist to come and move the brick for him. Mr. Sims, the secretary, admits that the men objected to work with non-unionists, so that here again we are confronted with the old tactics of bullying and intimidation by the unionist minority. If trades unionists want to earn respect and acknowledgment, they should see to it that their members are of such a class as to command respect, instead of endeavouring simply to build up a fighting fund by forcing all men into their fold. It is just this scooping in of the worst class of men that has made some of the trades unions a laughing stock of the country, and brought the name of the British workman into one of contempt. As an architect recently wrote, any ordinary man could learn to lay bricks in a week or 10 days, yet the wages' cost of building is being practically doubled or trebled by the action of the bricklayers, who could easily do four times the amount of work they now do.

Pocket Calculator.—We have received from the Scientific Publishing Company, of Manchester, a pocket calculator in the form of a stem-winding watch. It is really an adaptation of the slide rule, the various scales being laid off on a series of rings on a revolving circular dial. There are two pointers, under one of which the dial may be revolved to any desired point, while the other can be revolved by its own winder to any angle desired. By simple movements of the dial and pointer multiplication can be performed, division, roots, and powers can be found, and logs, sines, cosines, and hyperbolic logs. There are five circular scales: No. 1 of logarithms, No. 2 for multiplication and division and proportion, Nos. 3 and 4, really one scale, for square roots, and No. 5 a sine scale. We have tried several calculations, and having checked results have found a very fair approximation to correctness. With practice the eye would learn to read off fractions of a division with considerable accuracy, and it is claimed that such practice will enable results correct to 1 per cent. to be found, which is quite close enough for rough-and-ready calculations in engineering. The price is only 7s. 9d., and the instrument is strictly what it claims to be, a pocket calculator, for it is like a thin watch.

Another Water-tube Boiler.—In the *Engineers' Gazette* we find described the Miyabara water-tube boiler. It consists, briefly, of two tiers of small shells connected vertically by short, wide connections, and connected each to the opposite vessel one place higher by a series of slightly curved inclined tubes. The larger vessels form the front and back of a boiler as long as its furnace, and the products of combustion rise directly up from the grate amongst the tubes. The inventor appears to be a Japanese naval captain. It is claimed that a boiler tested and made by Messrs. Humphrys, Tennant & Co., at Deptford, burned 20 to 30 lbs. of coal per square foot of grate, and evaporated 11·87 lbs. from and at 212°. We need not dispute the figures, as they are not impossible. There is nothing said as to the coal used, but we would say that it must of necessity be coke or other smokeless fuel, as the boiler is arranged specially to make a large volume of smoke if bituminous fuel is used. As with all this class of boiler, the tubes enter the water vessels at non-radial angles. We hear so much about this class of tube never leaking, that we should like some maker to send us a description of the method employed in drilling out the holes for them and in making them tight when inserted.

Football.—The annual football match between the "Robertson" lamp-makers and the Edison and Swan lamp makers was played at Ponder's End on Saturday last, in the presence of a large crowd of spectators. After a most exciting game, the "Robertson" lamp-makers repeated their victory of last year by an increased margin of 3 to 1.

Mrs. Hopkinson's Gift to Cambridge University.—In his opening lecture to the engineering students at Cambridge on October 14th, Prof. Ewing intimated that the crowded state of their lecture rooms and laboratories would soon be relieved. A gift of £5,000 had just been made for the addition of a new wing to the engineering laboratory in memory of the late Dr. John Hopkinson and of his son, John Gustave Hopkinson, who recently lost their lives in the Alps. Dr. Hopkinson's son was to have begun work by this time as a student of engineering at Cambridge. This most splendid and welcome gift was made by Mrs. Hopkinson jointly with her son, Bertram, and her surviving daughter. Prof. Ewing went on to say:—"I feel impelled to add a few words as to the loss which our profession—the profession on which you look forward to entering—has met with in the untimely death of Dr. Hopkinson. If I were to select any name to put before you as that of an engineer whose work and methods you would do well to follow, it would be his. He was a peculiarly conspicuous example of that union of scientific knowledge and genius with practical sagacity which goes to make a great engineer. His work was brilliantly original; in more than one department he led the way where a great host is now following; and his work was as sound as it was brilliant. His opinion was constantly being sought, partly because it was always fair and unbiassed—his character was too fine for anything mean or unworthy to find a place—and partly because his judgment came near to being infallible. You know that he took in Cambridge the most distinguished place that any student can take. He at once plunged into engineering work, and from that time to the end his professional life was an unbroken series of successes. But he made time for much original work of lasting value in science, and the world of pure physics is deploring his loss as much as it is deplored by engineers. Such a man may, I think, be said to live on, not only in the results of his work, but in the force of his example. Dr. Hopkinson took from the first a warm interest in this laboratory and in the establishment of an Engineering Tripos at Cambridge. It was only a few days before his death that he spoke to me of his intention to promote a subscription for the much-needed extension of the laboratory. It is a peculiar pleasure to me to think that this laboratory will, through the noble gift of Mrs. Hopkinson and of his son and daughter, be henceforth associated with his memory and name."

The Position of Draughtsmen.—This correspondence continues in the *Engineer*, and has become extremely funny. One letter, to which we referred as "wrote sarkastic," complained that a man who was never heard of in the office, and did his work quietly, was actually appointed manager, whereas a smart fellow, who could "saw off" the end of his desk with his hand, and make a sound just like a cross-cut saw, was overlooked. Now an employer writes and characterises that letter as proof of the conceit and impudence of the "oppressed draughtsman" who wrote it, and he goes on to argue the question, and talks of the destruction of property, if "he really sawed it off," and so he goes on through the letter, and he is serious, too; but when we see his *locus scribendi*, we stop and say no more. His address is Glasgow. Yet perhaps after all we have here another draughtsman writing. This employer is made to talk about the better class of draughtsman—men worth, say, 30s. per week. Not much better class about this!!! However, our friend really is serious. He takes as serious the hunting cog story as well as the saw tale. Finally, he asks for plenty of good intelligent draughtsmen at a moderate price, just as we want cheap boots, and we again wonder whether there is a joke, or if a traditional national trait is before us, and so we leave the question about as we found it, in an unsatisfactory and unsolved condition.

Masthead Lights.—The Falmouth Chamber of Commerce has resolved to draw the attention of the Board of Trade to the danger of allowing electric light to be used as a masthead light. The matter had been prominently brought forward in connection with the wreck of the *Mohegan*, as it is declared that, owing to the electric light being extinguished, the lifeboats were unable to find the wreck.

The Bradford Tramway Accident.—As stated in the ELECTRICAL REVIEW last week, Major Cardew, C.E., resumed, on 13th inst., the Board of Trade inquiry as to the cause of the recent electric car accident. The first witness called was the driver, named Mungovin. He said that on the morning of the accident the rails were greasy, but he had plenty of sand, and used it freely. On commencing to descend the hill he applied the electric brake, gradually advancing the notches, but it took no effect. Then he tried the hand brake, and it failed also. He tried releasing it and applying it again four or five times, but without effect. The car gained speed, and went over at the curve. He thought of the electric reversal, but saw that the trolley was off the wire, and he knew it would not act. The driver said they had been told the electric brake would not lock the wheels of the car, but he thought it did on this occasion. Prior to the brakes failing to act, he had been going only 5 miles an hour. He was positive he did not reverse the electric power on the way down, and thus make the electric brake inoperative. To take the trolley off the wire was a foolish trick to do. The inspector said he had made experiments with the brakes, and was of opinion that they were sufficient if the cars were not allowed to go more than 6 miles an hour. It was pointed out that the electric brake would be of no use if the hand brake was put on, and a witness was called named Bailey, who said that he saw the conductor putting the hand brake on from the rear of the car. A doctor's certificate was put in, stating that the conductor of the car was not in a fit condition to attend, and it was agreed that the inspector should visit his house and secure the evidence, when the inquiry would be closed. In his statement to the inspector the conductor said that all went well until they reached Southfield Lane, where they stopped. He noticed the greasy condition of the rails, and said to the driver he wished he could put sand on. The driver replied: "Yes, but I have no sand in the box; it was all used last trip." When he was collecting the fares the car commenced to go fast—about 20 miles an hour—and he put the hand brake on at the rear of the car in consequence of what he took to be a signal from the driver.

Appointments Vacant.—The Heckmondwike Urban District Council is inviting applications for the appointment of consulting engineer to advise them on a scheme for an electric lighting installation for their township, and, if required, to superintend the construction of all works and the laying down of the necessary plant for that purpose. Plans and specifications of the scheme have already been prepared by an electrical engineer who is now deceased. For further particulars apply to the clerk to the Council.

The Barking Town Council want applications for the appointment of an electrical engineer to superintend the laying of mains and the erection of plant, and to run the station afterwards at £150 per annum. See our "Official Notices" this week.

The Edinburgh Corporation is wanting a superintendent of mains in connection with its electric lighting undertaking at £230 per annum. See our "Official Notices" this week for particulars.

The Metropolitan Asylums Board are wanting a thoroughly experienced engineer for the Park Fever Hospital, Hither Green, Lewisham, S.E. For details see our "Official Notices" this week.

The Southampton Corporation invites applications for the appointment of electrical engineer to take charge of their electrical undertaking at £250 per annum. See our "Official Notices" this week.

The Bedford Corporation are advertising for an assistant electrical engineer at £108 per annum. For particulars see our "Official Notices."

Presentation.—At the House-to-House Electric Light Supply Station, Earl's Court, on Saturday morning last, Mr. J. A. Constable was presented with a gold watch and framed address by the staff and employés on the occasion of his leaving the service of the company to take up the post of engineer to the Blackheath and Greenwich District Electric Lighting Company, Limited. Mr. H. W. Bowden, the manager and engineer, made the presentation in the main engine house, where all the employés met.

The Ventilation of Underground Electric Railways.—We consider the following article from the *Lancet* is worth printing in full as it touches upon an exceedingly important question:—"The substratum of the metropolis is being pierced in all directions radiating from the City for the construction of underground electric railways. The electric railway running from the north end of London Bridge to Stockwell has been in working order for some years now, and apparently without any serious hitch having happened in the arrangements. This is the more satisfactory because this line was the first in London, we believe, to apply electric motive power on an underground railway. Not very long ago another line was opened between the Mansion House and Waterloo which has already proved a great convenience to the public. Other lines are in progress. So far the lines completed show the indisputable advantage of electric traction over steam traction, at least for underground railways. The passages are free from choking sulphurous smoke and the atmosphere is as satisfactory as could be expected under the circumstances. A recent occurrence on the Waterloo and City Electric Railway would, however, seem to show that while the pollution of the underground air by smoke is of course avoided, no extra precautions have been taken for securing the adequate ventilation of the tunnel in the event of emergency. It must not be forgotten that visible smoke and plainly discerned smells serve after all in the ordinary underground railway as an excellent index of the state of the air, but in the absence of these things, as on the underground electric railways, there is no such guide, and insidious poisoning by repeatedly inspiring human exhalations is possible, if not, indeed, suffocation. To some extent these conditions were realised last week on the Waterloo and City line in consequence of the breakdown of a train. It appears that a train going Citywards was full to overflowing by reason of a crowd returning from viewing the Guards on their coming home from the Soudan. The motive power was unequal to the load, and the train stopped. The delay was sufficiently long to cause a marked sense of suffocation to the passengers and a degree of panic, while it is reported, also, that the lights failed. It was fortunate that the stoppage occurred within a comparatively short distance of the City end, so that ultimately the passengers could escape by leaving the train and walking the rest of the distance. It is assumed, and correctly, that the advance of a train through a tube which it closely fits is sufficient to maintain an adequate change of air in the tunnels, in which case no extra provision for ventilation need be made, but, in the event of a breakdown, the supply of air would soon be exhausted, and the result might be disastrous and comparable with the awful historic tragedy of the Black Hole of Calcutta. Either an improved system of keeping up a supply of air must be adopted on the underground electric railways, or else a relay of motors must be immediately at hand at both ends of the tunnel to draw the trains out in the event of a breakdown. The former course would be safer, for in the event of a train leaving the rails the delay would be necessarily great and correspondingly serious to the imprisoned passengers. The matter must be referred to the Board of Trade, which we hope, in the present instance, has not committed a serious oversight. Steps must be taken, if such by some inconceivable want of perspicuity is not already the case, to remove the awful possibility of suffocating a train-load of people. It would be interesting to know whether the underground electric lines in course of construction have included in their plans the provision of an air supply should any necessity arise."

Electric Pumping Plant.—The Yarmouth Town Council has decided to spend £3,000 in laying down pumps capable of raising 25,000 gallons per hour from the North Sea for various purposes, so that the available supply will be doubled, or 200,000,000 gallons per annum. The new pumps will be electrically driven by power supplied from the Corporation's generating station.

Appointment.—We learn that the Halifax Corporation has appointed Mr. Street the assistant electrical engineer at the electricity works to take the place vacated by Mr. T. P. Wilmshurst, at £300 per annum. Mr. Street has been at the works since their inauguration four years ago.

Telephonic Instruction by Correspondence.—Mr. Kempster B. Miller, one of the best known American telephone experts, is the instructor at the International Correspondence Schools, of Scranton, Pa., on the subject of telephony. The *Scientific American* in writing of the course says it is a remarkable one, and, like the other courses of this school, it is taught by mail. The telephony course is intended for electrical engineers, switchboard designers, inspectors and employés of telephone manufacturers, promoters and officers of telephone companies, members of construction boards, telephone superintendents, those in charge of interior systems, chief operators and operators, electricians in the navy and merchant marine, members of the Signal Corps of the army, street railway superintendents, &c. Few of the technical schools in this country give instruction relating to telephony, and the importance of the subject has not been sufficiently appreciated by electrical engineers. The course is intended not only to give the theory of telephony, but also to give an excellent idea of the practical work of the installation of the complete systems. The course commences at the beginning, which is acoustics, and takes the student from the fundamental principles of sound through the the theory of the multiple system; from the construction of the simplest private line through the complexities of the great multiple switchboard, the construction of which involves the use of thousands of miles of wire and hundreds of thousands of soldered joints. Our contemporary considers the instruction papers are most valuable, enabling one to obtain a competent knowledge of the subject.

Fatal Electric Shock.—According to a daily contemporary, the inquest was held on Wednesday at the Marylebone coroner's court, into the death of Henry Stagg, aged 32 years, an electric wireman, in the employment of the Metropolitan Electric Supply Company, who was on Sunday last killed at Rathbone Place, Oxford Street, where he was engaged covering wires leading to a switchboard. The deceased was, according to evidence, noticed to be in a semi-reclining position against the board, his feet being in contact with the terminals on the floor underneath the board, which was marked "Dangerous." There were rubber mats on the floor, and a fellow workman, who was with the deceased, deposed that he had never known rubber to be a conductor of electricity. There were 1,000 volts on at the time. The company's engineer gave it as his opinion that the deceased had fallen across the terminals of one of the machines. He had never known the force of 1,000 volts to kill a man before. The medical testimony was to the effect that death was due to electric shock, and a verdict of "Accidental death" was returned.

The Institution of Junior Engineers.—The annual general meeting of this Institution was held last Friday at the Westminster Palace Hotel, the retiring chairman, Mr. H. B. Vorley, presiding. There was a large attendance. From the report of the Council which was presented, it is evident that the society continues its work with a vitality which has always characterised it. The total membership stood at 516, a net increase of 36 on the year. Sympathetic reference was made to the loss which the Institution had sustained in the death of Dr. John Hopkinson, past-president, and of Sir Benjamin Dobson, of Bolton, and Mr. Thomas Mudd, of Hartlepool, hon. members. The ballot resulted in the election of the following:—Chairman, Mr. Basil H. Joy; vice-chairman, Mr. Kenneth Gray; hon. librarian, Mr. L. H. Rugg; hon. auditors, Messrs. W. B. Clarke and E. King; council, Messrs. J. N. Boot, F. D. Napier, J. E. Raworth, and A. E. Taylor; secretary and treasurer, Mr. W. T. Dunn. To-night Sir W. H. White, K.C.B., the new president, will deliver his inaugural address.

Randall Telephones.—In our last issue in a bankruptcy notice, mention was made of the Randall Telephone Patents Enterprise and the Randall Telephone Company, Limited. Mr. C. Adams Randall, of Chancery Lane, now writes to us for the purpose of avoiding misunderstanding. He says that although the Randall Telephone Patents Syndicate, and the Improved Telephone Patents, Limited, have been registered, he was not a party to either of these concerns, and they were registered without his knowledge or consent. He adds that neither of the companies have any rights under, or claims upon, his patents.

The Institution of Civil Engineers and Mr. Blakesley.—We have received a copy of a printed letter, addressed by Mr. T. H. Blakesley to Prof. W. E. Ayrton, on the subject of a misleading statement which has appeared in the Abstracts given in the *Proceedings of the Institution of Civil Engineers* relating to hysteresis. Mr. Blakesley has asked the Institution to correct the description of a test in which a Wheatstone bridge is used with alternating currents and a telephone detector, this test being quite wrong, and therefore liable to mislead. The Council has, however, apparently refused to insert this correction. Mr. Blakesley states that this action of the Institution is due to the fact that the latter ridiculed Mr. Blakesley about 15 years ago with respect to his theory of hysteresis, a theory which is now universally accepted. Mr. Blakesley is undoubtedly right, and the Institution wrong in regard to the facts of the case; but whether the Institution is so malicious or so generally inaccurate as is suggested may be doubted, nor is it quite certain that the matter is so momentous a one as to require its being taken up in the way he suggests.

The Northern Society of Electrical Engineers.—We are informed by the secretary of the "Northern Society of Electrical Engineers" that their fifth session will be opened on Tuesday evening next, the 25th inst., with an inaugural address by the President (Mr. John S. Raworth), the subject of which will be "The Rapid Development of Electrical Engineering in the year 1898." Papers will also be read during the session by the following gentlemen:—Mr. Paul Sehon, Mr. E. S. Shoults, Mr. Samuel Joyce, Mr. H. Kilgour, and Mr. S. V. Clirehugh. Meetings of the Society will be held in future on Tuesday evenings at the Grand Hotel, Aytoun Street, Manchester.

The following is a synopsis of Mr. Raworth's address:—1. The influence of the present conditions of the electrical industry on the Northern Society, including an apology for a second address. 2. An invitation to members and others to discuss the address and to supplement the information contained therein. 3. A reference to his presidential address, read before the society, January 10th, 1898. 4. Departments in which development has been more or less strongly marked. (*a*) electric lighting; (*b*) electric propulsion; (*c*) distribution of power; (*d*) electro-chemistry. 5. The principal influences which affect the rate of progress are:—(*a*) natural development; (*b*) cost of plant and working; (*c*) Parliamentary procedure; (*d*) avarice of municipalities; (*e*) energy of private enterprise. 6. The influence of foreign competition. 7. The educated capitalist.

Booming "Electricity Supply" Shares.—In the Electrical Review of July 29th, 1898, we referred at considerable length to the Rowbotham primary battery, which was being exploited by the New Electricity Supply Syndicate. We are afraid that the name of this syndicate has misled the public, and given rise to the impression that the company is engaged in the business of electricity supply. That belief may, or may not, be partly responsible for the booming of the shares on the market. Within the past few weeks, if we are to give credence to statements in the financial columns of the London papers, the £1 shares have been run up as high as £13 to £14, but on the 12th inst. they got on the downward track, and some days ago were offered at as low a figure as £4, and as there were no buyers at that price, there is no telling how much lower they may fall. The *Pall Mall Gazette* may well ask "What has become of the supporters of this affair?" One financial contemporary associates this syndicate with the electric lighting shares, and remarks that there is a general weakness in the market for such securities. This seems to us to indicate the confusion that exists in the public mind as to the objects of the syndicate. We think it is time that the public was enlightened.

Electrical Affairs at Durban.—At the meeting of the Town Council at Durban on September 14th, it was decided, says the *Standard and Diggers' News*, that the borough electrical engineer should proceed to England in order to expedite the delivery of additional lighting plant, required on account of the large demand made by the public since the reduction to 9d. per unit, and also that the engineer should gather information as to electric traction.

Association of Municipal Corporations.—This Association has this week been holding its autumn general meeting at the Westminster Palace Hotel. Among the subjects considered on Wednesday was that of municipalities and rival electrical companies. The Mayor of Nottingham moved the following resolution :—"That this Association affirms the principle that, where local authorities have, with the sanction of Parliament, established undertakings for public benefit, and have not failed in the performance of their duties, it is not right or expedient that powers should be granted to companies to compete with such local authorities." The resolution was suggested by the Bill of the General Power Distributing Company, which had passed the House of Lords, and during its progress through the House of Commons had been carried over to the next session, when it was to be taken up at the point at which it had then reached. The resolution was seconded by the Lord Mayor of Sheffield, and supported in strong speeches by the town clerk of Liverpool, the town clerks of Doncaster, Dewsbury, Southport, and others, and unanimously agreed to, with a slight amendment making it applicable to places where undertakings were in course of being established by the local authorities. There was also a brief discussion on the question of telephone licenses, but no resolution was passed.

Blast Furnace Gas as a Motive Power.—An article appreciative of the use of blast furnace gas for power purposes appears in *Cassier's Magazine* from Mr. H. Savage, the engineer of the Société Cockerill, of Seraing, who have adopted Mr. B. H. Thwaites's system, and now heartily approves of the same. Mr. Savage agrees to claim from 150,000 to 180,000 cubic feet of gas from each ton of pig iron production, and states that the dust difficulty so much feared by a German professor has no real existence. He advocates the deposition of dust in large chambers, and sees in an ironworks an unlimited source of power. Steam boilers, gas fired, consume 600 to 700 feet of gas per I.H.P. The Seraing trials showed 20 H.P. per ton of coke per day, so that the half-dozen furnaces at Seraing would produce 12,000 to 14,000 I.H.P. This power should be electrically distributed. The first engine put down at Seraing was of 8 H.P. only. At first it gave only 4 H.P., but after modification, no doubt at the gas entrance, it gave 8 H.P. In the new 200-H.P. engine it is hoped to secure a horse-power with only 105 cubic feet of gas. This has not, so far, been effected, M. Witz showing 124 cubic feet per hour. At the Cockerill works the gas is taken through three pairs of coke scrubbers, with water jets. The fly-wheel weighs 15 tons, and initial pressure is 8 atmospheres, or 115 lbs. Mr. Savage appears to claim for Seraing the pioneer position in this new development, whereas the prior claim certainly belongs to England, in the shape of the plant at Wishaw, which Mr. Savage is kind enough to allow may be mentioned, though he must be fully aware that the Wishaw plant was the first, and that Mr. Thwaites's suggestion of the system was at the beginning of the Cockerill decision to try the system themselves. And foreigners talk of perfidious Albion!

Transformer Inspection at Bangkok.—In the British Consular Court, before his Honour Mr. Archer, on September 9th, the case was heard of the Bangkok Electric Light Company *v.* Captain and Owners of ss. *Charon*. Plaintiffs asked that Mr. Bennett be allowed to inspect the electric transformers and examine them. Mr. Tilleke, on behalf of the defendants, replied that the Court must order the inspection, and that they were willing to let Mr. Bennett come and see the transformers, but without the Court's order they would not allow him to open and examine them, as the defendants contended that they were in "good order." After some discussion, his Honour ordered the defendants to allow Mr. Bennett to inspect, open, and examine the transformers.

Organ Blowing by Electricity.—The new organ to be opened in Lincoln Cathedral on November 17th is to be blown by means of electric power, motors being installed for the purpose.

The Smoke Nuisance in London.—The Public Control Committee of the London County Council have just issued a report in which they give a brief account of the steps taken to put a stop to the serious nuisance from smoke in London. With certain exceptions, the Committee believed that the more serious nuisance from black smoke came to an end in July last, and had only since recurred from time to time on two or three premises with which they were dealing.

The Opening of Belfast Electricity Works.—The new electricity station of the Belfast Corporation was opened on Tuesday by the Lord-Lieutenant of Ireland amid much enthusiasm. Luncheon was served in the Ulster Hall at 2 o'clock.

The Webb Testimonial.—We are desired by the honorary secretary of the Webb Testimonial Committee to state that since the date of the presentation the sum of £51 12s. 7d. has been received by subscriptions and interest on the bank deposit. The account at the bank has now been closed, but the amount of any further subscriptions that may be received will be handed direct to Mr. Webb.

Portrait of Mr. J. W. Swan, F.R.S., President I.E.E.—We understand that Mr. Swan is much annoyed that many of his friends are being solicited to subscribe for a lithographic portrait of himself, with a lithographed signature. We believe this is being done entirely against his wishes, and we are informed that the likeness is not a good one.

Personal.—On September 13th Mr. A. H. Preece gave a dinner in the Café de Paris, Buenos Ayres, to the principal officers of the Primitiva Gas Company, for which company Mr. Preece is consulting electrical engineer. On the 15th inst. Mr. Preece and a few friends were entertained at the Club Progreso by the officers of the company. Mr. Preece left for home on September 17th by R.M.S. *Danube*.

NEW COMPANIES REGISTERED.

East's Boat Building Company, Limited (59,116).—This company was registered on October 11th, with a capital of £15,000 in £1 shares, to enter into an agreement with Alexander W. Poplet, and to carry on business of builders of steam and electric launches, houseboats, skiffs, punts, canoes, &c., boat builders and fitters, suppliers of electricity and other power for propelling boats, &c. The subscribers (with one share each) are:—Robert M. Blaikie, 6, Leicester Road, East Croydon, chartered accountant; Frederick W. Cope, 18, Connaught Mansions, Prince of Wales's Road, S.W., clerk; Ernest Crapper, 9, Hobury Road, Chelsea, S.W., gentleman; Walter E. Brown, Hampden House, Hampden Street, N.W., traveller; James Prichard, 44a, Portland Place North, Clapham Road, S.W., gentleman; David J. Douglass, 1, Albert Road, Peckham, gentleman; and Herbert R. Herbert, 194, Dulwich Rise, S.E., clerk. The first directors (to number not less than three nor more than seven) are to be appointed by the subscribers; qualification, £100; remuneration £300 per annum, divided between them.

Deep Leads Electric Transmission Company, Limited (59,117).—This company was registered on October 11th, with a capital of £20,000 in £1 shares, to carry on the business of an electric power company in all its branches, to erect, establish, and maintain stations and works for the generation of electricity, and to enter into agreements with the "Charlotte Plains Proprietary Gold Mines, Limited," the "Junction Deep Leads of Victoria, Limited," and the "New Havillah Gold Mining Company, Limited." The subscribers (with one share each) are:—Arthur Butler, J.P., 71, Cadogan Square, S.W.; Oliver Wethered, 28-29, St. Swithin's Lane, E.C., engineer; Edward B. Wyman, 29, St. Swithin's Lane, E.C., gentleman; Robert M. King, Fryern, Pulborough, gentleman; J. M. Courtney, care of Cox & Co, 15, Charing Cross, S.W., major-general; G. H. Maitland King, Dunsborough, Ripley, Surrey; S. M. Fergusson, 58, Stanhope Gardens, S.W., stock jobber. The first directors (to number

three) are to be appointed by the subscribers; qualification, £250, or being on the directorate of a company holding £1,000; remuneration, £1 each per board meeting attended.

Hedley's, Limited (59,179).—This company was registered on October 15th, with a capital of £10,000 in £1 shares, to enter into an agreement with Wm. B. Hedley for the acquisition of the business carried on by him at Oak Road, West Bromwich, Staffs., and to carry on the business of mechanical and electrical engineers, machine tool makers, iron and brass founders, consulting engineers, machinery agents, and general mill furnishers. The subscribers (with one share each) are:—Wm. B. Hedley, 28, Oak Road, West Bromwich, engineer; R. J. Richardson, 76, Broad Street, Birmingham, engineer; J. B. Onions and S. A. Onions, Tysley Grange, near Birmingham, engineers; C. Harrison, 10, Newhall Street, Birmingham, chartered accountant; F. A. Moore, 40, Oak Road, West Bromwich, machinist; S. R. Wood, 71, Temple Row, Birmingham, clerk. The number of directors is not to be less than two nor more than five; the first are Wm. B. Hedley, Simon A. Onions, James B. Onions, and Rees J. Richardson; qualification, £100; remuneration, £10 each per annum.

Blackpool, St. Anne's, and Lytham Tramways Company, Limited (59,184).—This company was registered on October 17th, with a capital of £100,000 in £1 shares, to enter into an agreement with the Blackpool, St. Anne's, and Lytham Tramways Company, for the acquisition of its business, and to equip, maintain, and work by electricity, steam, gas, horse or other power, the tramways owned by the company. The subscribers (with one share each) are:—William Bratby, Hale, Bowdon, Cheshire, merchant; Frank Hollins, Grey Friars, Preston, cotton spinner; Edward Bryning, Highgate House, near Kirkham, merchant; Thomas Blane, Central Beach, Blackpool, chartered accountant; D. Kemp, The Towers, Promenade, Blackpool, manufacturer; A. W. Carrington, Church Road, Lytham, cotton manufacturer; M. Guthrie, 76, Princes Road, Liverpool, gentleman. The first directors (to number not less than three nor more than seven) are to be nominated by the subscribers; qualification, £300; remuneration as fixed by the company.

Claud Hamilton, Limited (4,021).—This company was registered in Edinburgh on October 13th, with a capital of £50,000 in £1 shares, to acquire and carry on the business of electrical engineers and contractors carried on at 247, St. Vincent Street, Glasgow, by a company of the same name. The subscribers (with one share each) are:—Claud Hamilton and David Alexander, 247, St. Vincent Street, Glasgow, engineers; R. Fraser and A. Fergusson, 232, West George Street, Glasgow, chartered accountants; R. Mackay and R. Clement-Boyd, 82, West Regent Street, Glasgow, writers; William McKinnel, 234, Nithsdale Road. Pollokshields, merchant. The number of directors is not to be less than two nor more than five; the first are Wm. McKinnel, Alex. Fergusson, and Claud Hamilton; qualification, 200 shares; remuneration, £200 per annum.

CITY NOTES.

The Brazilian Submarine Telegraph Company, Limited.

THE report of the directors and the accounts for the half-year ended June 30th, 1898, to be submitted to the fiftieth ordinary general meeting, October 26th, 1898, states that the revenue for this period amounted to £103,689 2s. 7d., and the working expenses to £21,474 4s. 6d. After providing £3,200 for debenture interest and sinking fund, and £1,713 2s. 8d. for income-tax, there remains a balance of £77,301 15s. 5d.; to this is added the sum of £8,662 4s. 2d. brought forward from December 31st last, making a total of £85,963 19s. 7d. A quarterly interim dividend, amounting to £19,500, has been paid, and £25,000 transferred to the reserve fund. The directors now recommend the declaration of a final dividend of 3s. per share, making, with the interim dividends, a total dividend of 6 per cent. for the year, and also the payment of a bonus of 2s. per share, both free of income-tax, which together will amount to £32,500, leaving a balance of £8,963 19s. 7d. to be carried forward. The dividend and bonus will be payable on 27th inst. The directors are pleased to report that shareholders in the Western and Brazilian Telegraph Company, Limited, holding considerably more than three-fourths of the capital, have assented to the exchange of their shares for shares in this company. The agreement of July 14th, 1898, between the companies has therefore now become operative, the exchange of directors between the boards has taken place, and the closer union and more effective working of the systems of the associated companies has thus been assured. Mr. Richard Collett, who has been secretary of the company since its formation in 1873, and who has rendered the company excellent service, has now retired from that office. Mr. W. H. Axworthy and Mr. E. S. Hodson have been appointed manager and secretary respectively.

Eastern Extension Telegraph Company.

THE report of the directors for the half-year ended June 30th last, to be submitted to the general meeting to be held on 26th inst., states that the gross receipts, including Government subsidies, have amounted during that period to £277,283, against £290,749 for the corresponding half-year of 1897. The working expenses, including £29,877 for cost of repairs to cables and expenses of ships, absorb £102,874, against £99,426 for the corresponding period of 1897, leaving a balance of £174,409. From this is deducted £4,629 for income-tax, £31,895 for interest on debentures, debenture stock and contribution to sinking fund, and £14,662 for bonus to staff, leaving £123,223 as the net profit for the half-year. Two quarterly interim dividends of 1½ per cent. each, amounting to £62,500, have been paid for the half-year, leaving £60,723, of which £50,000 has been transferred to the general reserve fund, and the balance of £10,723 is carried forward. Further renewals of weak portions of the company's cables have been carried out during the half-year, and the cost charged against the general reserve fund. In consequence of the outbreak of hostilities between Spain and the United States, telegraphic communication with the Philippines was entirely suspended from May 2nd until August 21st. The Hong Kong-Manila cable was interrupted on May 2nd, and the Manila-Panay cable on 23rd of that month, both sections having been cut by the American forces besieging Manila. Under the circumstances no attempt was made by the company to restore communication until the peace preliminaries were signed, when an arrangement was come to with both the Spanish and American Governments for reopening the cables on a neutral basis. Thereupon the company's staff repaired the cables, and the company is now working direct with the public at Manila, instead of through the medium of the Spanish officials as heretofore.

The Fort William Electric Lighting Company, Limited.

THE report of the directors presented at the ordinary meeting last month contained the following items:—

"The directors recommend that the balance of revenue of £298 0s. 10d. be applied in payment of a dividend of 2½ per cent. for the year from April 30th, 1897, on the original capital of £7,000, and a like dividend on the increased capital of £2,000 from February 1st (the date of allotment) to meet which dividend a sum of £187 3s. 10d. will be required.

"Having in view that the final one-third of the preliminary expenses has yet to be met, the directors recommend that the balance of £110 17s. be carried forward to the credit of next year's account."

Stock Exchange Notices.—The Stock Exchange Committee has appointed as a special settling day Wednesday, October 26th in London Electric Supply Corporation, Limited—110,000 ordinary shares of £3 each, fully paid, Nos. 1 to 110,000; 48,050 6 per cent. preference shares of £5 each, fully paid, Nos. 1 to 50,000; £200,000 4 per cent. first mortgage debenture stock. The ordinary and preference shares are to be quoted in the Official List.

Claud Hamilton, Limited.—This week this company, which will develop the business now carried on at 247, St. Vincent Street, Glasgow, as electrical engineers and contractors, under the name of Claud Hamilton, Limited, has been before the Scottish investor. The capital is £50,000 in £1 shares, 20,000 preference, and 30,000 ordinary, and the present issue is of the preference shares (5 per cent.). The list closed on Wednesday.

Aron Electricity Meter, Limited.—Letters of allotment of the capital offered for subscription have been posted.

TRAFFIC RECEIPTS.

The Bristol Tramways and Carriage Company, Limited.—The receipts for the week ending October 14th, 1898, were £2,664 8s. 7d.; corresponding period, 1897, £2,543 0s. 1d.; increase, £121 8s. 6d.

The City and South London Railway Company.—The receipts for the week ending October 16th, 1898, were £1,002; week ending October 17th, 1897 £960; increase, £42; total receipts for half-year, 1898, £15,253; corresponding period, 1897, £14,551; increase, £702.

The Dover Corporation Electric Tramways.—The receipts for the week ending October 15th, 1898, were £182 0s. 10d.; week ending October 16th, 1897, £129 12s. 9d.; increase, £52 8s. 1d.; total receipts to October 15th, 1898, £6,900 9s. 6d.

The Dublin United Tramways Company.—The receipts for the week ending October 14th, 1898, were as follows:—D. U. T. Co., horse cars, £2,647 16s.; ditto, electric cars, £412 8s. 8d.; D. S. D. Co., electric cars, £885 3s. 6d.; total, £3,945 8s. 2d.; corresponding week last year—D. U. T. Co., horse cars, £2 993 1ls. 6d.; D. S. D. Co., electric cars, £469 6s.; total, £3,462 18s. 6d.; increase, £482 9s. 8d.; aggregate to date, £65,745 6s. 9d.; aggregate to date last year, £60,286 16s. 4d.; increase to date, £5,459 10s. 5d. Worked:—The mileage open is 13 miles electrically, 31 miles by horses, as against 8 miles electrically, and 34 miles by horses, for the corresponding period last year.

The Liverpool Overhead Railway Company.—The receipts for the week ending October 16th, 1898, amounted to £1,388; corresponding week last year, £1,296; increase, £92.

The Western and Brazilian Telegraph Company, Limited.—The receipts for the week ending October 14th, 1898, after deducting 17 per cent. of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited, were £3,491.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1895.	1896.	1897.	Closing Quotation, Oct. 12th.	Closing Quotation, Oct. 19th.	Business done during week ended Oct. 19th. 1898. Highest.	Lowest.
137,400£	African Direct Telegraph, 4 % Debs.	100	4 %	...	...	100 —104	100 —104	102½	101½
25,000	Amazon Telegraph, shares	10	...	...	...	6 — 7	6 — 7	...	...
125,000	Do. do. 5 % Debs. Red.	100	...	...	...	92 — 95	92 — 95	...	...
923,960£	Anglo-American Telegraph	Stock	£2 9s	£2 13s	3 %	64 — 67	63 — 66 xd	65	...
3,038,020£	Do. do. 6 % Pref.	Stock	£4 18s	£5 6s	6 %	115½—116½	113½—114½	114⅜	114⅛
3,038,020£	Do. do. Deferred...	Stock	...	...	...	15½— 16	15¼— 15⅜	15⅝	15⅜
130,000	Brazilian Submarine Telegraph	10	7 %	7 %	7 %	15⅜— 16¼	15⅜— 16¼	16⅛	15⅛
75,000£	Do. do. 5 % Debs. 2nd series, 1906 ...	100	5 %	...	...	111 —115	111 —115	...	...
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	4 %	4 %	2¾— 3¼	2¾— 3¼	...	...
10,000,000$	Commercial Cable	$100	7 %	8 %	8 %	180 —190	180 —190	...	...
918,297£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	104 —106	104 —106	106	105½
224,850	Consolidated Telephone Construction and Manufacturing	10/-	1½ %	2 %	...	1/16— 3/16	1/16— 3/16	...	...
16,000	Cuba Telegraph	10	8 %	8 %	7 %	8½— 9½	8½— 9½	...	...
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	15 — 16	15½— 16½	...	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	4 %	4 — 5	4 — 5	...	...
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 — 11	10 — 11	...	...
30,000£	Do. do. 4½ % Debs., Nos. 1 to 6,000 ...	50	4½ %	4½ %	4½ %	103 —106%	103 —106%	...	...
60,710£	Direct United States Cable	20	2¼ %	2¼ %	...	11½— 12	11½— 12 xd	11⅛	11⅛
120,000	Direct West India Cable, 4½ % Reg. Deb.	100	...	...	...	101 —104	101 —104	...	...
400,000	Eastern Telegraph, Nos. 1 to 400,000	10	6½ %	6½ %	7 %	17¾— 18⅛	17¾— 18¼xd	18 1/16	17¾
1,295,000	Do. 3½ % Pref. Stock	100	...	...	...	105 —108	104 —107 xd	106	104¼
40,000	Do. Prov. Certs., 50 % paid	...	...	...	...	52 — 55	52 — 55 xd	...	...
89,900	Do. 5 % Debs., repayable August, 1899 ...	100	5 %	5 %	5 %	100 —103	100 —103	...	...
1,302,615£	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	126 —130	126 —130	128½	127
250,000	Eastern Extension, Australasia, and China Telegraph ...	10	7 %	7 %	7 %	17½— 18	17½— 18 xd	18	17½
25,200£	Do. 5 % (Aus. Gov. Sub.) Deb., 1900, red. ann. drgs., reg. 1—1,049, 3,976—4,326	100	5 %	5 %	5 %	100 —104	100 —104	..	...
100,500£	Do. do. Bearer, 1,050—3,975, 4,327—6,400	100	5 %	5 %	5 %	101 —104	101 —104	...	...
320,000£	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	125 —129	125 —129	...	...
35,100£	Eastern and South African Telegraph, 5 % Mort. Deb., 1900 red. ann. drgs., Reg. Nos. 1 to 2,343	100	5 %	5 %	...	100 —104	100 —104	102¼	...
46,500£	Do. do. do. to bearer, 2,344 to 5,500	100	5 %	5 %	...	101 —104	101 —104	...	...
300,000£	Do. 4 % Mort. Debs., Nos. 1 to 3,000, red. 1909	100	4 %	4 %	...	102 —105	102 —105	...	...
200,000£	Do. 4% Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	4 %	4 %	...	104 —107%	104 —107%	...	...
180,227	Globe Telegraph and Trust	10	4½ %	4½ %	4½ %	12 — 12½	12 — 12½	12½	12¼
180,042	Do. do. 6 % Pref.	10	6 %	6 %	6 %	16¾— 17½	16¾— 17½	17	16⅞
150,000	Great Northern Telegraph, of Copenhagen...	10	10 %	10 %	10 %	28½— 29½	28½— 29½	...	...
160,000£	Do. do. do. do. 5 % Debs. ...	100	5 %	5 %	5 %	101 —104	101 —104	...	...
97,000	Halifax & Bermuda Cable, 4½% 1st. Mt. Dbs., w'n. 1-1,200, rd.	100	...	...	...	101 —104	101 —104	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	51 — 54	52 —55	...	...
100,000£	London Platino-Brazilian Telegraph, 6 % Debs.	100	6 %	6 %	6 %	109 —112	109 —112	...	...
28,000	Montevideo Telephone, 6 % Pref., Nos. 1 to 28,000 ...	5	4 %	4 %	4 %	2¼— 2⅜	2¼— 2⅜	...	...
484,597	National Telephone, 1 to 484,597	5	5½ %	5½ %	6 %	5⅜— 5⅝	5¼— 5½	5 7/16	5 5/16
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	13⅜	13
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	12¾	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	5⅜— 5⅝	5¼— 5½	5 7/16	5 5/16
1,329,471£	Do. 3½ % Deb. Stock Red.	Stock	3½ %	3½ %	3½ %	100—105	100 —105	102	101¼
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	5 %	5 %	⅝— ¾	⅝— ¾	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000 ...	100	4 %	4 %	4 %	105 —108	105 —108	...	...
11,839	Reuter's	8	5 %	5 %	5 %	8 — 9	8 — 9	...	...
3,381	Submarine Cables Trust	Cert.	...	...	...	136 —141	133 —138 xd	...	...
58,000	United River Plate Telephone	5	4 %	5 %	6 %	4¼— 4⅜	4¼— 4⅜	4¼	...
146,733£	Do. do. 5 % Debs.	Stock	5 %	...	...	103 —106	103 —106	...	...
15,609	West African Telegraph, 7,501 to 23,109	10	4 %	nil	nil	3½— 4½	3½— 4½	...	...
213,400£	Do. do. 5 % Debs.	100	5 %	5 %	5 %	99 —102	99 —102	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	¼— ⅜	¼— ⅜	...	...
150,000	Do. do. 4% Debs., 1—1,500 gua. by Braz. Sub. Tel.	100	...	...	...	104 —107	104 —107	...	...
64,269	Western and Brazilian Telegraph	15	3 %	2 %	3½ %	12¼— 12⅜	12¼— 12⅜	12⅜	12
33,129	Do. do. do. 5 % Pref. Ord.	7½	5 %	5 %	5 %	8 — 8½	8 — 8½	8½	...
33,129	Do. do. do. Def. Ord.	7½	1 %	nil	½ %	4 — 4½	4 — 4½	4 1/16	...
389,521	Do. do. do. 4 % Deb. Stock Red. ...	Stock	...	...	...	107 —110	107 —110	108½	...
88,321	West India and Panama Telegraph	10	½ %	1 %	¾ %	1 — 1¼	1 — 1¼	1⅛	1⅛
34,563	Do. do. do. 6 % Cum. 1st Pref. ...	10	6 %	6 %	6 %	9¼— 9⅜	9¼— 9⅜	9⅜	9 7/16
4,669	Do. do. do. 6 % Cum. 2nd Pref. ...	10	6 %	6 %	6 %	7 — 9	7 — 9	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	106 —109	106 —109	...	...
1,163,000$	Western Union of U.S. Telegraph, 7 % 1st Mort. Bonds	$1000	7 %	7 %	7 %	105 —110	105 —110	...	...
160,100£	Do. do. do. 6 % Ster. Bonds ...	100	6 %	6 %	6 %	98 —103	98 —103	...	...

ELECTRICITY SUPPLY COMPANIES.

30,000	Charing Cross and Strand Electricity Supply	5	5 %	6 %	7 %	11½— 12½	11½— 12½	...	...
20,000	Do. do. do. do. 4½ % Cum. Pref.	5	...	...	...	6 — 6½	6 — 6½	...	...
26,000	*Chelsea Electricity Supply, Ord., Nos. 1 to 10,277... ...	5	5 %	5 %	6 %	9 — 10	8½— 9½	9⅜	9
60,000	Do. do. do. 4½ % Deb. Stock Red....	Stock	4½ %	4½ %	4½ %	113 —115	113 —115	114	113
50,000	City of London Electric Lighting, Ord. 40,001—90,000 ...	10	5 %	7 %	10 %	24 — 25	23 — 24	24½	23½
10,000	Do. Ord. Nos. 90,001 to 100,000	10	...	...	...	23½— 24½	22½— 23½	24¼	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	16½— 17½	16 — 17	...	...
400,000	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	5 %	5 %	5 %	127 — 132	127 —132	130⅜	...
30,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—30,000	10	nil	nil	nil	13 — 14	12½— 13½	13⅜	13
10,000	Do. do. do. Nos. 30,001 to 40,000 £8 paid.	10	...	...	...	10½— 11½	10 — 11	...	...
20,000	Do. do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	14½— 15½	14½— 15½	...	...
17,400	Edmundsons Elec. Corp., Ord. Shares 1—17,400	5	...	...	5 %	5½— 5¾	5 — 5½	5¼	5⅛
10,000	House-to-House Electric Light Supply, Ord., 101 to 10,100	5	...	...	4 %	9 — 10	9 — 10	...	...
10,000	Do. do. 7 % Cum. Pref. ...	5	7 %	7 %	7 %	9½— 10½	9½— 10½	...	...
62,400	*Metropolitan Electric Supply, 101 to 62,500	10	4 %	5 %	6 %	16½— 17½	15 — 16	16⅜	16
220,000£	Do. 4½ % First Mortgage Debenture Stock	...	4½ %	4½ %	4½ %	117 —121	117 —121	120	...
6,452	Notting Hill Electric Lighting	10	2 %	4 %	6 %	15½— 16½	15½— 16½	17	...
31,980	*St. James's and Pall Mall Electric Light, Ord.	5	7½ %	10½ %	14½ %	16½— 17½	16½— 17½	...	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	9 — 10	9 — 10	...	...
50,000	Do. do. 4 % Deb. Stock Red. ...	Stock	...	...	4 %	104 —107	104 —107	...	...
43,341	South London Electricity Supply, Ord., £2 paid	5	...	...	...	2⅞— 3⅛	2⅞— 3⅛	3	...
79,900	Westminster Electric Supply, Ord., 101 to 80,000 ...	5	7 %	9 %	12 %	15½— 16½	14½— 15½	15¾	15½

* Subject to Founder's Shares. † Quotations on Liverpool Stock Exchange.
‡ Unless otherwise stated all shares are fully paid. ‖ Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked ‖ are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last three years. 1895.	1896.	1897.	Closing Quotation Oct. 12th.	Closing Quotation Oct. 19th.	Business done during week ended Oct. 19th, 1898. Highest.	Lowest.
60,000	Aluminium "A" shares, Nos. 1—60,000	1	...	...	...	2⅞— 3⅛	3 — 3¼	...	...
90,000	Do. 4½ % 1st Mort. Deb. Stock Red.	Stock	...	...	...	94 —100	94 —100 xd	...	...
30,000	British Electric Traction	10	...	...	...	16¾— 17¼	16¾— 17¼	17⅛	16 13/16
10,000	Do. do. 6 % Cum. Pref. 30,001—40,000 (issued at £2 10s. prem. all pd.)	10	...	...	...	13 — 14	13 — 14	13¾	13⅜
90,000	Brush Elecl. Enging., Ord., 1 to 90,000	3	2½%	*nil*	*nil*	1⅜— 2	1⅜— 2	1 15/16	...
90,000	Do. do. Non-cum. 6 % Pref., 1 to 90,000	2	3 %	*nil*	4 %	2⅛— 2⅜	2¼— 2½	...	...
125,000*l*	Do. do. 4½ % Perp. Deb. Stock ...	Stock	...	...	...	109 —113	109 —113	...	...
50,000	Do. do. 4½ % 2nd Deb. Stock Red. ...	Stock	...	...	...	102 —105	103 —106	105	103¼
20,000	Callender's Cable Construction shares, Nos. 1—20,000 ...	5	...	...	...	10 — 11	10 — 11	...	...
90,000	Do. do 4½ % 1st Mort. Deb. Stock Red.	Stock	...	...	...	110 —113	110—113	...	...
19,894	Central London Railway, Ord. Shares	10	...	...	...	10 — 10½	10 — 10½	10½	10½
129,179	Do. do. do. £6 paid	10	...	...	...	6 — 6½	6 — 6½	...	...
59,254	Do. do. Pref. half-shares £1 paid ...	...	...	...	...	1¼— 1⅜	1¼— 1⅜	1⅜	...
67,680	Do. do. Def. do. £5 paid ...	...	...	...	...	4½— 5	4½— 5	4⅝	...
630,000*l*	City and South London Railway	Stock	1 8/16 %	1 9/16 %	1⅝ %	70 — 72	70 — 72	71⅝	71¼
22,500	Do. do. Ord. shares, Nos. 1 to 22,500 £3 pd.	10	...	...	...	2⅜— 3¼	2⅜— 3¼	3	...
32,098	Crompton & Co., Nos. 1 to 32,098	3	...	...	...	1½— 2	1½— 2	...	...
82,850	Do. 5% 1st Mort. Reg. Debs., 1 to 743 of £100, and 901 to 1,070 of £50 Red.	...	...	...	...	90 — 95	90 — 95	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	5 %	5⅛%	6 %	2¼— 2⅜	2¼— 2⅜	...	...
17,139	Do. do. do. "A" Shares, 01—017,139	5	5 %	5⅛%	6 %	4 — 5	4 — 5	4½	...
194,023	Do. do. do. 4 % Deb. Stock Red. ...	100	...	...	...	101 —103	101 —103	101	...
110,000	Electric Construction, 1 to 110,000	2	5 %	6 %	6 %	2⅛— 2⅜	2⅛— 2⅜	2 5/16	2⅛
16,343	Do. do. 7 % Cum. Pref., 1 to 16,343 ...	2	7 %	7 %	7 %	2¾— 3¼	2¾— 3¼	...	...
111,100	Do. do. 4% Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	105 —107	105 —107	...	...
91,196	Elmore's Patent Copper Depositing, 1 to 70,000	2	...	...	...	⅝— ⅝	⅝— ⅝	...	...
67,275	Elmore's Wire Manufacturing, 1 to 69,385, issued at 1 pm.	2	...	...	...	¼— ½	¼— ½	...	...
9,600*l*	Greenwood & Batley, 7 % Cum. Pref., 1 to 9,600 ...	10	10½%	7 %	7 %	10 — 12	10 — 12	...	...
12,500	Henley's (W. T.) Telegraph Works, Ord.	10	8 %	10 %	12 %	20½— 21½	20½— 21½	21 7/16	20¾
3,000	Do. do. do. 7 % Pref.	10	7 %	7 %	7 %	18 — 19	18 — 19	...	...
50,000	Do. do. do. 4½ Mort. Deb. Stock...	Stock	4½%	4½%	4½%	110 —115	110 —115	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	10 %	22½— 23½	22½— 23½	22 13/16	22⅜
300,000	Do. do. do. 4 % 1st Mort. Debs.	100	...	...	...	101 —105	102 —106	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	2⅜ %	2⅞ %	3¼%	10⅜ — 10½	10⅜— 10½	...	...
10,000	† Do. do. Pref., £10 paid	10	5 %	5 %	5 %	15½— 16	15½— 16	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	39 — 43	39 — 43	41¼	39½
150,000	Do. do. do. 5 % Bonds, red. 1899	100	5 %	5 %	5 %	100 —103	100 —103	...	...
540,000*l*	Waterloo and City Railway, Ord. Stock	100	...	...	...	115 —120	113 —118	116	114

† Quotations on Liverpool Stock Exchange.
‡ Unless otherwise stated all shares are fully paid.
Dividends marked ‡ are for a year consisting of the latter part of one year and the first part of the next.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

*Birmingham Electric Supply, Ordinary £5 (fully paid) 10½.
British Aluminium, Ordinary, 10½—11½; 7 % Pref., 12—13.
House-to-House, 4½% Debentures of £100, 105—108.
Kensington and Knightsbridge Electric Lighting, Ordinary Shares £5 (fully paid) 13½—14½; 1st Preference Cumulative 6%, £5 (fully paid), 8—8½. Debentures, 105—108. Dividend, 1897, on Ordinary Shares 10%.
London Electric Supply Corporation, £5 Ordinary, 3½—4.
National Electric Free Wiring, 10s. paid, ⅜—½.
*T. Parker, £10 (fully paid), 14—15.
Yorkshire House-to-House Electricity, £5 Ordinary Shares fully paid, 7½—8. Dividend for 1896—6%.

* From Birmingham Share List.

Bank rate of discount 4 per cent. (October 13th, 1898).

MARKET QUOTATIONS, Wednesday, October 19th.

CHEMICALS, &c.	This week.	Last week.	Increase or Decrease.
a Acid, Hydrochloric .. .. per cwt.	5/-	5/-	..
a „ Nitric .. .. .. per cwt.	22/-	22/-	..
a „ Oxalic .. .. .. per cwt.	39/-	39/-	..
a „ Sulphuric .. .. .. per cwt.	5/6	5/6	..
a Ammoniac, Sal .. .. per ton	37/-	37/-	..
a Ammonia, Muriate (grey) .. per ton	£19	£19	..
a „ „ (white) .. per ton	£26	£26	..
a Bleaching powder .. .. per ton	£6 15	£6 15	..
a Bisulphide of Carbon .. .. per ton	£15	£15	..
a Borax .. .. .. per ton	£14 10s.	£14 10s.	..
a Benzole (90 %) .. .. .. per gal.	7/-	7/-	..
a „ (50/90 %) .. .. per gal.	5/6	5/6	..
a Copper Sulphate .. .. .. per ton	£18	£17	£1 inc.
a Lead, Nitrate .. .. .. per ton	£23 10s.	£23 10s.	..
a „ White Sugar .. .. per ton	£30 10s.	£30 10s.	..
a „ Peroxide .. .. .. per ton	£27 10s.	£27 10s.	..
a Methylated Spirit .. .. per gal.	2/9	2/9	..
a Naphtha, Solvent (90 % at 160° C.) .. .. per gal.	5/6	5/6	..
a Potash, Bichromate, in casks.. per lb.	3¾d.	3¾d.	..
a „ Caustic (75/80 %) .. per ton	£24	£24	..
a „ Bisulphate .. .. per ton	£35	£35	..
a Shellac .. .. .. per cwt.	64/-	64/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers .. per ton	£6 10	£6 10	..
a „ Recovered .. .. per ton	£5 10	£5 10	..
a „ Lump .. .. .. per ton	£5	£5	..
a Soda, Caustic (white 70 %) .. per ton	£8 15	£8 15	..
a „ Crystals .. .. .. per ton	£3	£3	..
a „ Bichromate, casks .. per lb.	3d.	3d.	..

METALS, &c.	This week.	Last week.	Increase or Decrease.
b Aluminium Wire, in ton lots .. per ton	£224	£224	..
b „ Sheet, in ton lots .. per ton	£191	£191	..
c Brass (rolled metal 2" to 12") basis per lb.	6½d.	6½d.	½d. inc.
c „ Tube (brazed) .. .. per lb.	8½d.	8½d.	..
c „ Wire, basis .. .. per lb.	6¾d.	6¼d.	½d. inc.
f Ebonite Rod .. .. .. per lb.	3/-	3/-	..
f „ Sheet .. .. .. per lb.	5/-	5/-	..
g Copper Bars .. .. .. per ton	£63 10	£63	10s. inc.
g „ Wire (basis price) .. per lb.	7¾d.	7½d.	½d. inc.
g „ Sheet .. .. .. per ton	£63 10	£63	10s. inc.
g „ Rod .. .. .. per ton	£63 10	£63	10s. inc.
n German Silver Wire .. .. per lb.	1/6	1/6	..
h Gutta-percha, fine .. .. per lb.	5/6	5/6	..
h India-rubber, Para fine .. per lb.	3/9½ forw'rd	3/9½	..
i Iron, Charcoal Sheets .. .. per ton	£18	£18	..
i „ Pig (Cleveland warrants) per ton	45/3	44/2½	1s. 0½d. inc.
i „ Forgings, according to size per ton	From £11	From £11	..
i „ Scrap, heavy .. .. per ton	45/-	45/-	..
i „ Wire galvanised No. 8 .. per ton	£8 15	£8 15	..
g Lead, English Ingot .. .. per ton	£13 5	£13 5	..
g „ „ Sheet .. .. per ton	£14 2 6	£14 5	2s. 6d. dec.
l Mica (uncut slabs 8" long) .. per bottle	5/6	5/6	..
m Manganin Wire No. 28.. .. per lb.	8/-	8/-	..
g Mercury .. .. per bottle	£7 4	£7 4	..
o Platinum .. .. per oz.	£2 16	£2 16	..
i Steel, Magnet, according to description .. .. .. per ton	to £40	From £15	..
i Steel, Magnet, in bars	£58	£58	..
g Tin, block .. .. .. per ton	£84 15	£80 10	£4 5s. inc.
g „ foil .. .. .. per lb.	1/3	1/3	..
n „ wire Nos. 1 to 16 .. .. per lb.	1/4	..	..
j Yarns, Cotton, Single 10lb. bundles pr lb	6¾d.	6¾d.	..
j „ Flax, 6 or 8 lea... .. per lb.	3¾d.	3¾d.	..
j „ Hemp, 3 ply 10 lbs. .. per lb.	3½d.	3½d.	..
j „ „ Russian, 10 lbs. per lb.	4½d.	4½d.	..
j „ Jute, 180 lbs. rove .. per ton	£11 10	£11 10	..
j „ Manila, 24 thread .. per ton	£31	£31	..
k Zinc, Sheet (Vielle Montagne bnd.) p. t.	£w7	£w7	..

a Quotations supplied by Messrs. G. Boor & Co.
b „ „ „ The British Aluminium Co., Ltd
c „ „ „ Messrs. Thos. Bolton & Sons.
d „ „ „
e „ „ „
f „ „ „ The India-Rubber, G.-P., and Teleg. Works Co Ltd
g „ „ „ Messrs. James & Shakspeare.
h „ „ „ „ Jackson & Till.
i Quotations supplied by Messrs. Bolling & Lowe.
j „ „ „ „ Henry C. Yeo & Co.
k „ „ „ „ Morris Ashby, Limited.
l „ „ „ „ Sanders, Wake & Co.
m „ „ „ „ W. T. Glover & Co., Ltd.
n „ „ „ „ P. Ormiston & Sons.
o „ „ „ „ Johnson Matthey & Co.

THE OLDEST STEAM ENGINE IN EXISTENCE.

A paragraph has recently been going round the papers relative to a steam pumping engine erected in the year 1777 by Boulton & Watt, at the Rolfe Street pumping station of the Birmingham Canal Company. It was of the single acting wooden beam type, no doubt very similar to the old engine at South Kensington. Doubtless the engine is a favourable example of what can be done with good machinery in the way of long continued service. The old Cornish pumping engines, worked by men who, at that early day, did not think it strange or out of the way practice to put steam into a cylinder kept as hot as the steam itself, gave results in economy probably fully as good as anything secured to-day, taking into consideration the difference due to differences of pressure, and there is no reason to doubt that this old Birmingham engine has been as economical as it is probable any engine at a low pressure would be. At the same time, we can hardly doubt but that this old engine might, with commercial economy, have long since given way to a new engine at higher pressure, and the canal company would have saved a good deal of fuel. Pumping engines, no doubt, have the right to live perhaps longer than most engines, for they seem capable of being economically worked at lower pressures than other engines, but there is a tendency to preserve machinery by too careful use, long after the time it ought to be upon the scrap heap.

A lathe costs £60. It is attended by a man who receives £100 annually. The lathe costs, say, £3 annually, and with care will last 20 years. Used more hardly it wants replacing in 10 years. To save this tool the man only does 80 per cent. of what he could do on the machine. Thus it costs £20 annually to take care of the lathe as compared with driving it hard. In 10 years' time this lathe has cost £200 extra in order that it may last another 10 years. Thus, to save £60 there has been spent £200, and a loss of £140 has really been made, and this does not take into account the occupancy of the room in which a man and lathe at £100 wages have been doing £80 worth of work, nor of the delays due to slow work, nor of the extra men and space to do the work that the too-much-cared-for tool is not allowed to do. In this one item of tools alone there is enough to explain the success of American competition. The sooner a tool can be worn out, or the management can find the pluck to scrap it, the sooner can a new tool with latest improvements take its place. Americans drive their tools for all they are worth. If they had English tools and drove them to the same extent—for all they were worth—they would turn out still more work than they do. Englishmen with heavier tools do less work with them, simply because of this taking care exemplified in the maintaining of the above old engine, the remarkable thing about which is that it has been working practically all through the life of the United States as an independent nation. Why was it not in a museum long ago? We believe that the confusion between a workshop and a museum is much less marked than it was, and that the evil is becoming better recognised, but there is still too much respect paid to pieces of old iron for sentiment's sake. If a museum is to be kept, and every shop might perhaps keep one with advantage, it should be a separate room wherein history and sentiment could be housed together, and my grandfather's lathe allowed a well earned repose.

THE COLLAPSING RESISTANCE OF FLUE TUBES.

In the annual report of Mr. M. Longridge, the chief engineer of the Engine and Boiler Insurance Company, there is given a description of tests made upon a boiler flue tube of about 33 inches diameter. We need not detail the gaugings of this tube and its departure from the truly circular form. Suffice to say, the two tubes tested were 18 feet 6 inches long, made up of six plates telescopically plated, lap jointed, and single riveted, and about ·36 inch to ·37 inch thick, and of iron. Had the flues been circular they would probably have collapsed at about 150 lbs. pressure. As it was they were more or less oval, and for different degrees of oval the collapsing pressure was as follows:—

110 lbs. for flue about...	...	...	$\frac{3}{32}$	inch oval		
60	"	"	...	...	...	$1\frac{5}{16}$	"	
100	"	"	...	...	...	$\frac{1}{16}$	"	(?)
85	"	"	...	...	...	$\frac{3}{32}$	"	

The (?) expresses a doubt as to the correctness of the measurement of this tube.

It is concluded that strength is very materially affected by deviation from true circularity.

That long flues which fail by crumpling preserve their elasticity under pressures approximating closely to that of final collapse, and, therefore, they may be worked with much less factors of safety than short flues which fail by crushing of material.

The use, during the experiments, of pit props to shore up tubes which began to fail enabled higher pressures to be applied. This is taken as evidencing the value of cross tubes. We do not agree with Mr. Longridge here. The bare record of fact may be true, but cross tubes in modern boilers are doubtful additions to the strength of a flanged seam tube which fails by crushing of its material rather than by crumpling of the plate.

Moreover, there are no cross tubes in the furnace where they are most likely to be needed when a tube gets overheated, and finally cross tubes cause smoke, and, by covering the plates with soot, they more than counteract any action they may have as increased heating surface. The cross tube is a vicious addition to an internally fired boiler, and probably no one knows this better than Mr. Longridge. Of course, the flues he tested were old and not of the sort ever likely to be repeated. Cross tubes may be all right as props to such old lap-jointed tubes, but they ought to go out of date with the old tubes they serve to stiffen. Modern boilers are better without such useless makeweights.

SCIENTIFIC AND LITERARY EDUCATION.

It is not altogether to be deplored that a man eminent in so dry a subject—to the majority—as geology, as Sir A. Geikie, should put in a plea for the older education at the opening of the session of the Mason College, Birmingham. By all means we would press forward the scientific training of engineers and manufacturers, but we would not allow the classical side of education to be neglected. The development of the trashy novel of late years has run in parallel with scientific education, and we fear that there are very many men to-day, sprung from the humbler ranks of life, who, having received fair scientific training, have neglected the broader education, and are but boors after all, and quite unfit for decent society, having lost touch with the decencies of their own station, and not gained those of a higher. In a greater or less degree the same remarks can be applied to the vice of specialisation, where this is allowed to become a vice. Specialists are apt to become narrow. It is to the specialist in every grade of life, and especially to him who has neglected the literary side of education, that the garbage of writing is due. Unable to be always on the rack of work, such men, in the absence of a taste for good literature, become consumers of every form of light literature—most of it trash. Sir Archibald recognises this tendency, and would have all men cultivate the better side of education, not only to make them socially possible, but to render them capable of putting their knowledge into the hands of other men—a proceeding now often painful from lack of the barest knowledge of putting their thoughts in writing. Scientific teaching, moreover, has been far from sound, and it were better to be smaller in bulk and superior in quality. The reaction against the older education is doubtless now receiving a check. For a time any literary attainments were quite at a discount, and the land bid fair to be swamped with semi-biologists and half-baked geologists who could see nothing but blank atheism in the want of correspondence between Moses and the thickness of the chalk deposit, and downright infidelity in the peculiarities of embryology. We appear to have got a bit clear of this attitude, but there are still too many unlettered scientists in our midst for life to be over pleasant. Life is too busy for most men to cultivate a taste for the humanities when their working days begin. It must have been acquired in youth. Anyone can acquire later a knowledge of science if he have the capacity for doing so, but it is ten times as difficult to acquire that which once could only be acquired by the few, but which now the many might acquire if our national system of education were properly conducted in place of being made the tilting ground of faddists.

WATER SOFTENING.

People who provide mechanical stokers, special forms of furnace bar, and sundry adjuncts of steam-using plant, are never so happy as when abusing each other in the press. To a certain extent the same remarks apply to those who soften water. Recently, in *Engineering*, Mr. Atkins, who has a water-softening system, wrote in reference to a paper by Mr. Archbutt, who also has a system. Mr. Atkins softens and filters out the residual non-depositing fine carbonate. Mr. Archbutt, after softening, gets rid of the fine remaining carbonate by re-bicarbonating it, and so making it soluble. This bicarbonating is done by means of the fumes of a coke fire.

There is no serious harm in the fumes of a coke fire, but Mr. Atkins writes of them as though they were something very pernicious. It ought to be known that, speaking generally, the softening of water is a very simple chemical operation. The usual impurity is carbonate of lime with usually much less of carbonate of magnesia. Both these salts are very slightly soluble in water. Their bicarbonates are soluble, and it is as bicarbonates they are found in water. Expressed in symbols, Ca O (lime) + CO_2 (carbonic acid), is insoluble. Add a second volume of CO_2, and the result is Ca O + 2 (CO_2), or soluble bicarbonate of lime. If now there be added another molecule of lime, the result will be that the lime which has no carbonic acid will rob the lime, which has a double share of it, of one-half, thus [Ca O + 2 (CO_2)] + Ca O = 2 [Ca O + CO_2]. But this means that the whole of the lime has become insoluble carbonate, and as such, given time, it will all deposit. Softening apparatus are simply tanks and mixers and depositing trays, variously arranged to carry out the process. Where water contains other salts the process is less simple and effective. Sulphate of lime, for example, can be got rid of by means of carbonate of soda, for the two bases exchange their acids, and the sulphate of lime becomes the insoluble carbonate of lime, while the carbonate of soda is changed to sulphate of soda, a very soluble salt, which, however, must not be allowed to accumulate to too serious an extent before changing the water in a boiler. According to its design and attention, ordinary softening apparatus is found more or less satisfactory.

All the usual apparatus are based on the Porter-Clark process. Mr. Atkins states that if the carbonates are dealt with the lime sulphate may be neglected. This may be so for domestic purposes, but for sulphate waters in steam boilers we think this statement is open to dissent. We think it a little late in the day for anyone to claim to

bs a sole inventor of a system of carrying out the Porter-Clark process. Undoubtedly when softening is well carried out, as it can be, the results are valuable in labour and fuel saved.

Chalk water from wells is readily treated with simple lime, but when pumped from the river, as from the Thames, full as it is of the sewage of Oxford, Reading, Abingdon, and other places, whose sewage is good enough for Londoners to drink, it is found that the process is delayed by the presence of so much organic matter—the modern name for filth, and a certain coagulation is necessary. This is usually obtained by alum, a small quantity of which serves to coagulate the albuminous matter, and greatly assists to precipitate the carbonate of lime which is dragged down with the coagulate. We should recommend all steam users to employ some system of water softening. Mr. Atkins has one based on the Porter-Clark process, the Archbutt-Deeley process is another, and Messrs. Gimson Bros., of Leicester, have the original Porter-Clark process, and there are doubtless others.

ELECTRIC LIGHTING IN MARYLEBONE.

The proceedings in connection with the application last session by the Vestry of Marylebone for an electric lighting provisional order will be so fresh in the minds of our readers, that it will only be necessary to recapitulate the facts that the Vestry's request was granted by the Board of Trade, that the Marylebone Electric Supply Company was unsuccessful in its efforts to obtain powers, and that the Select Committee of the House of Commons, after several days' consideration, declined to pass that portion of the Bill (introduced to confirm the orders granted by the Board of Trade to the Vestries of Marylebone and Bermondsey) relating to Marylebone. Since then the suspicion has been entertained by a certain section of the members of the Marylebone Vestry that the latter's case was not properly represented before the Select Committee of the House of Commons. Led by Mr. J. Anglim, one of the labour members, the malcontents two or three weeks ago succeeded in getting a special resolution passed ordering the printing and circulation among the members of the minutes of the proceedings of the Select Committee. This has now been done, and pending a consideration of the details the Electric Lighting Committee, at the usual meeting last week, recommended: "That formal notice be given on or before November 1st to the Metropolitan Electric Supply Company, Limited, of the Vestry's intention to proceed for a provisional order for the public and private, or public or private, lighting of the parish by electricity."

Mr. T. H. Brooke-Hitching, who moved the adoption of the recommendation, said that it was unanimously carried in Committee. The passing of the resolution was nothing more than agreeing to the writing of a letter and the cost of a postage stamp. The Committee would have an opportunity before November 18th of considering whether they would recommend the Vestry to proceed beyond that point, but at the present time no liability would be incurred by the adoption of the recommendation.

Mr. W. L. Strong having seconded the resolution,

Mr. E. White expressed his inability to understand why the Electric Lighting Committee had brought forward such a recommendation in face of the snub administered by Parliament. Perhaps from £2,000 to £3,000 of the ratepayers' money had been thrown away on the scheme, and yet they were asked by the Committee to apply again to the Board of Trade for a provisional order, and if they obtained it, to then go to the House of Commons with the same result. In his opinion it was doubtful whether the Board of Trade would grant an order, in view of the decision of the House of Commons in the matter. If the recommendation was adopted, the Vestry would be embarking upon a forlorn hope and an unknown expenditure. Mr. Hitching had stated before the House of Commons' Committee that the Vestry were prepared to expend £250,000 on the installation.

Mr. Brooke-Hitching interposed with the remark that that statement was not true.

Mr. White accepted the denial. Continuing, he said he thought it would be well to wait another year, and not rush the question because of being angry. Did they not think it necessary to know something about the case that had been before them prior to entering into the matter again? The ratepayers would not be pleased with them if they did so unless they knew the cause of the failure in the past.

Mr. W. Dennis was sorry the previous speaker had held the Committee up to ridicule because of failure. The Committee had made a big effort, but had failed, owing to the preponderating influence of monopolists in the House of Commons. He agreed with Mr. White that, before embarking upon the scheme, it was desirable to have an opportunity of perusing the minutes of the proceedings, which they ought to have in a very short time. He felt very strongly upon the question. Having expended a large sum of money they ought not to throw up the sponge, but to move everything possible to secure electric lighting powers. He was not at all satisfied that, because there was one company in the parish, the local authority should not also exercise similar powers. It was a gigantic mistake that the company had been allowed to enter the locality, especially if it meant that the Vestry could not commence operations for 42 years. That was an error of judgment, but he hoped the Vestry would permit the resolution to be carried.

Mr. Crook, who agreed with the resolution, stated that it would be suicidal not to give the notice embodied in the recommendation.

Sir Edwin Galsworthy contended that it was all very well to say that the giving of notice would cost nothing; but if any objections were raised on the Committee submitting a further recommendation on the subject, they would ask them why they had given notice to the company. He was inclined to think that the chances of the Vestry being successful would be much better if they did not hurry; there would certainly be no harm done in delaying action for one year. The speaker saw the preliminary difficulty pointed out by Mr. White. What chance was there of obtaining a provisional order this year, so soon after the past failure? He always had in mind the enormous expense in which the parish would ultimately be landed if they carried out the scheme. Mr. Hitching had denied saying the Vestry was prepared to expend £250,000 on the installation, but the speaker was anxious that all steps that might lead to such a result should have much more attention than the Marylebone Church Act, which was involving the Vestry in an expenditure of £80,000. It was advisable not to commit themselves again. The electric lighting companies had expended a vast deal more money in laying down machinery and founding their businesses than would have been necessary if they had to establish themselves in the light of present experience, and every day they heard of new inventions and improvements in machinery requiring the displacement of old and the substitution of new plant. His own impression was that that evolution would continue for many years, and he was alarmed at the idea of being rushed in that manner. The speaker agreed that the electric lighting business should be in the hands of the parish authorities, but he could not help thinking it would be wise to wait another year. The Vestry received a letter the other day from the Metropolitan Electric Supply Company, stating the concessions to be made in January. Perhaps the company would be prepared to do more. Let them wait and see without committing themselves. He would strongly advise the Vestry, with a view to ultimate success, that they should not be in a violent hurry at the present time, and he therefore moved an amendment: "That no such notice be given this year."

Mr. H. A. Dunn, who seconded the amendment, observed that if progress was desired, it would be well to proceed slowly. If they now applied for an order it would probably prejudice their case.

Mr. J. Lewis remarked that when Sir Edwin Galsworthy had the minutes before him he would alter his opinion. He asked the chairman, who was the champion of the Metropolitan Company—their friend, Mr. White. The company were to be congratulated upon having such an able advocate. The speaker said that delay was positively dangerous, and contended that the House of Commons' Committee had over-ridden the law, quoting, for the purpose of his argument, the clause relating to companies and local authorities in the same area of supply. If the matter was left for another year it would be allowed to drift on, but he hoped, after having read the minutes, the Vestry would apply this year and win.

Messrs. Anglim, Warren and others, joined in the debate, after which, the chairman of the Electric Lighting Committee replied to the discussion.

Mr. Brooke-Hitching, in reply, said that when he initiated the electric lighting agitation in Marylebone the company charged 7½d. per unit. It had now been reduced to 6d., and for parish buildings to 4d. As a consequence, he ventured to say the ratepayers, or at all events, the consumers, had gained considerably by the Vestry's expenditure of £2,000. The question was not confined to public and private lighting. It might be that the Vestry would establish an installation for street lighting and the public buildings only, and that was the reason for the resolution being framed as it was. Was Sir Edwin Galsworthy aware that the County of London and Brush Provincial Electric Lighting Company, and the Marylebone Electric Supply Company, had given notice of intention to apply for competitive powers in that district? Was the Marylebone Vestry to be left out?

Sir Edwin Galsworthy said that he did not know that was the case, or he would not have moved the amendment.

Continuing, Mr. Hitching said that it was a fact. He assured the members that the Committee were not only studying the interests of the Vestry, but also of the inhabitants of the parish. They were all against monopoly, and if they could only break it down they would obtain both a cheaper and a better light. That there was a demand for light was shown by the fact that 2,000 ratepayers had signed a petition introduced in favour of one of the companies seeking a provisional order. He hoped the Vestry would pass the resolution.

The mover and seconder of the amendment then withdrew their opposition, and the recommendation of the Committee was unanimously adopted.

NEW YORK TRAMWAY MEETING.

Tramways are known as street railways in America, and the Street Railway Association of the State of New York has been holding its annual convention at New York. We need not refer to any paper in great detail, but will confine our remarks to the general bearing of the Association and its work.

To quote the president's words, the interest in the cable system is now purely historical. Though for heavy grades it still has a place, its day has passed as a means of general transportation. It appears also that accidents to the public from electrical tramways are growing fewer, and the lines are looked on with less disfavour than formerly. The general note struck at the New York Convention was, however, a peculiar one. It appeared to be clearly recognised

that travel must be artificially stimulated, and as with railroad chairmen on our own side of the ocean, we find the president of the convention talking thus:—

"I am satisfied that the morals, health and habits of communities have been largely benefited at a very small expenditure on their part by the entertainments and inducements offered by the railroad companies."

Now what are these inducements to travel? With us the railways profess to induce travel by cheaper week-end tickets, holiday excursions, and so on, though it is remarked that they make so many restrictions as to the time a passenger may leave, and so many more as to limiting his return to certain days, that many would-be passengers are deterred and stay at home. Beyond this we do not find railway companies extending their energies In America, however, if we are to judge by one paper and the discussion it involved, the electrical roads make direct efforts to induce traffic by providing not so much a special rate for travel, but something at the other end to which to travel. There is established, therefore, a special traffic department, in charge of a clerk competent to receive all manner of callers, from the "ad." canvasser to the Society girl wanting to charter a special car, this latter caller no doubt acting as a pleasing antidote to the first. In quest of such new traffic one line agreed with property owners to extend their line a mile if said owners would establish a pleasure resort. This was done, and Bergen Beach was thus established, and as many as 50,000 persons daily have visited the place. And so on the author of the paper dealt with "high coloured posters" and other various forms of advertising the restless public.

One line pays up to £600 a week for amusements, which is found to more than recoup itself in increased business. This line is at New Orleans. The entertainments are free to all passengers for a fare of 7½d. for a round trip of 12 miles. The rate is thus a little over ½d. per mile. At Boston, a line is described where the entertainments embrace a band, "respectable" as to quality, and "immense" as to quantity, such that it can be heard in Boston, a 20 cent fare distant, so that at the cheap American fare it must be a good distance off, and there must be a lot of sound. Indeed, the distance is stated further on as 6¼ miles. The foregoing is a very brief abstract of this particular paper by Mr. Kennedy, who is a general passenger agent. It is evident that great efforts are made to stimulate traffic, and in a way that English companies could hardly attempt under their Acts or powers, though they might offer facilities. But surely there must be a field open for that street railroad which should be able to advertise a park with no bands, no theatre, no minstrels, and no anything, some place where a weary mortal could have peace and quiet.

The paper by Dr. Fenner on "Bye-Products of a Power House" has a livelier interest. It deals with the sale of waste steam, the moral being why condense, if practically all the heat can be sold. At Dunkirk a road only 3½ miles long connects Dunkirk's 12,000 people to 4,000 people at a village named Fredonia and the trunk line railroads. A service of 18 hours daily is run at half-hour intervals. When a horse line its capital was £11,400, and its fare 7½d., it paid 8 per cent., and there was no debt.

Now the capital is £23,240, and there is a debt of £12,000 or so. The fare is now only 5d., yet the dividend is still 6 per cent.: but half of this comes from "manufacturing," which means selling waste steam. The steam is sold on the basis of about 17s. per ton for best anthracite, and it is sold by meter. Its pressure is 4 to 6 lbs., and if it is less than this it is made up with live steam to that pressure.

The water is drained out of the pipes to cooling coils, and some heat is got from these. It is then run to the sewers. Why cannot it be sold to laundries? As regards the cost in fuel at one pound back pressure, there was no more coal consumed by the steam plant. At 2 lbs. there was a small difference, and at 4 lbs. the cost was £3 per month with coal at 6s. per ton.

The system employed is the Holly system of Lockport, of which no special description is given, except that the insulation consists of the following:—

An iron pipe carries the steam. It is wrapped in asbestos and supported on rests 1 inch high in a bored (*sic*) log, the bore being 2 inches larger than the pipe. The log has a shell 4 inches thick, lined with tin (*sic*) submitted to materials to prevent water soaking and decay. Three-ply tarred felt is laid over all, and the whole rests on a board bottom to the trench, which is underdrained by tiles. The arrangement is such as to enable steam to be carried long distances. One power and light company write that their plant cost $40,000, and brings in a revenue of $10,000, of which $8,000 is clear profit. Another company say they carry steam as far as a mile. Usually sold by the meter; steam is also sold per unit area of surface or by contents of space heated. The exhaust from 100 H.P. of engines will heat a million cubic feet of space in average buildings in the severest weather.

In some places live steam is sold at a profit. Prof. Carpenter stated that the loss by radiation could be reduced to one-fifth with good insulation as compared with bare pipe. He also said that with properly piped buildings a pressure of 1 lb. was sufficient. Were steam heating not so backward and imperfect in England, there ought to be great scope for our electric supply companies to supply steam heat instead of, as now, wasting it. By condensing we may save 10 to 20 per cent. Selling waste steam seems to bring its fuel value. The one point noticeable is, that a horse tramway paid 8 per cent., whereas an electrical tramway can only contrive to pay 6 per cent. by the aid of its bye-products.

Evidently some of the electrical progress in America has been made against shareholders' interests.

Rail bonds formed the subject of a paper by Messrs. Brown and Chapin, of the Brooklyn Heights Railroad Company.

They designed a rail bond when the new construction with 9-inch girder rails was inaugurated. As the joints were suspended, arrangements were made to bond beneath. A cast-copper band was employed as wide as the base of the rail with a surface contact of 12 square inches on each rail. The copper had a section 5 inches × ⅛ inch, and it was curved to allow for expansion. A cast-iron reinforcing plate was put under the copper and the band was pressed firmly to the rail by two ½-inch through bolts. The only machine work done on this bond is the grinding of the contact faces by a portable emery wheel. An attempt to prevent corrosion was made by a shallow groove round the contact space filled with soft pitch. It was unsuccessful, but so far since 1895 the conductivity of the rails thus bonded has been maintained.

Their cost is no greater than No. 0000 going round the fish-plate, and of treble resistance of the new bond. In 1896 an electrically brazed bond was tried and has now become standard. This bond in its various forms is made of 10 or 12 leaves of $\frac{1}{64}$-inch soft copper, the carrying portion 1¾-inch, and the contacts are 1 square inch. The solder is soft spelter. The bonds are brazed to the rails in the yard and the ends are interlaced when in position in the road, riveted and soldered. Where horseshoe bonds are employed on lighter lines they are of No. 0000 with ¾ ends driven tight into cleaned drilled holes in the rails. Bonds of every type are in duplicate.

Falk cast welded joints are almost equal to a continuous rail in conductivity, and the welded rail promises to be equally good. All bonds are tested for resistance. The results of some tests are as follows:—

Joint.	Drop. Volts.		Conductivity per cent.	
	1 ft. of rail.	1 ft. with joint.	30 ft. rail.	60 ft. rail.
Falk	·00215	·00355	98	99
Double brazed joint...	·00725	·00758	99 8	99 9
Welded (2 ft.) ...	·00364 (6 in.)	·00342	95 6	97 8
Plate bond (2 ft.) ...	·0109 (6 in.)	0233	89	94

Satisfactory double bonding should not exceed 75 cents per joint (say, 3s. 3d.). Any one of the above bonds will carry 600 amperes. Bonds are better not tinned, but painted in order that any leakage may go from the rail, not from the bond, so saving the rail from corrosion.

Regarding the quality of rails, it was pointed out by Mr. A. J. Moore, of the Lorain Steel Company, that whereas the soft rail was many years ago adopted by the L. & N.W. Railway of England, and the practice supported by the

P.R.R., the tramway is under different conditions, and demands a hard rail. Experiments on the West End Line, of Boston, U.S., with soft and hard ductile steel, showed that the results from 17 soft rails of ·28 carbon, 14 hard rails of ·59 carbon, and the rails furnished by the West End Company were in favour of hardness and ductility. The average monthly wear was ·0017 for the soft rail, ·0012 for hard rails, and ·0007 for West End rails. The specific gravity of the iron, apart from the metalloids in their composition, was respectively ·7956, ·7971, and ·7977, the best rail having the highest specific gravity. Tension tests showed 75,860, 118,100, and 120,380 lbs., the higher tension showing better durability; but the elastic limit does not follow the rule, for the figures are 45,730, 62,500, and 53,160, and similarly in compression the elastic limits are 35,000, 50,300, and 47,100. The real point of difference between the hard and the West End rail was the lower phosphorus and higher manganese.

Evidently low phosphorus is the thing to aim at, and as this costs money to obtain, it is a question how far it pays to secure it. To-day 6s. to 8s. per ton may be spent on reducing phosphorus below Bessemer standard of 0·10. With an average cost of $25 per ton, low phosphorus would cost an additional 8 per cent. Assuming it to be possible to use a rail until it has worn ½ inch down in the head, the wear found above represents a life of 25, 35, and 60 years, so that apparently low phosphorus at 8 per cent. pays well. But as a fact, nothing like this wear is obtained, because rails are thrown out, not for wear, but for bad joints, which cause rapid destruction. As a hard rail can be bought as cheaply as a soft rail, being hardened only by carbon, the cheapest rail to-day is the simple hard rail, but with perfect joints the West End quality would justify its extra cost. Cast welding would do this did it not soften the rail at the joint. Electric welding would do it. A wear of 45 or 50 years would be given by a rail analysing as follows:—

Carbon	... ...	0·55
Si.	... ...	0·10 or below
P.	... ...	0·08 "
S.	... ...	0·06 "
Mn	... ...	0·83 and not over 1·00

But, until joints are perfect, the cheapest steel one can buy will outlast the joints, all which points to the enormous economy of a perfect joint.

From a paper by Mr. D. F. Carver, it appears that American track construction is a little crude to our eyes. On a good foundation are laid yellow pine ties, four square sawn, of 4½ square feet bearing surface on foundation. There are 24 to a 60-feet rail. The ties and the rails are tamped. Joints are set close, though in time expansion will force the track out of line, but the method adds to the life of the joints.

In block-paved streets the rails are filled by Hemlock planks. One speaker advocated the concrete base. He would put this in by digging a trench 20 inches × 17 inches, suspending the rail and tamping up to the rail with the concrete.

On the question of storage batteries, evidence was forthcoming to show that these were being used with satisfaction, taking up sudden calls for power and proving an economy where a plant has reached its limit of power capacity for heavy hours.

METHODS OF DETERMINING THE FREQUENCY OF ALTERNATING CURRENTS.*

By CARL KINSLEY, Instructor of Physics and Electrical Engineering, Washington University, St. Louis, Mo.

The accurate determination of the frequency is essential for the correct computation of the relations between E.M.F., current, self-induction, and capacity. Since the periodicity must usually be squared, it is essential that the determination be made quickly and with but little error.

Dr. John Hopkinson was the first to use a stretched steel wire actuated by an electro-magnet, and when the condition of maximum resonance was found the periodicity was calculated from the constants of the wire and its tension.

Dr. Campbell * proposed the use of an iron rod which was thrown into resonance in the same way. From the constants of the rod and its length the periodicity was computed. The rod he found could be more easily used than the wire.

Another method capable of great accuracy and easy manipulation includes the use of a telephone in the alternating current circuit, and a resonance tube by means of which the periodicity may be calculated from equations, or it can be gathered from tables already computed.†

A very satisfactory method will be one which includes the use of a metal strip as the primary resonator, whose periodicity may be changed by means of an added weight. An electro-magnet may be used, as in the first two cases, to set this into vibration. The periodicity can be calculated from the constants of the vibrator‡ or a complete calibration can be made by two determinations. It will usually be more satisfactory to standardise by actually determining the periodicity of two adjustments of the resonator. The equation to be used for that purpose is

$$t^2 - D\,l^3\,M + K\,l^4, \text{ when}$$

t = time of one complete oscillation,
l = distance of the sliding weight from the support,
M = mass of the slider,
l = length of the vibrating rod.

D and K are the constants of this particular apparatus, which may be either calculated or obtained by experiment.

The condition of resonance is obtained with great readiness and the determination may be made with as great accuracy as may be desired.

AN ODD WRECK.

There appears in the accompanying illustration, taken from the New York *Electrical World*, a view of a 30-kw. bipolar compound-wound upright type of dynamo which was, on August 6th, subjected to a wreck rather difficult to account for. The details are described as follows by Mr. James T. Freeman, of Rochester, N.Y.:—

On the evening mentioned this 30-kw. dynamo was called upon to carry a night load of 200 amperes at 110 volts. The load at the time of the transfer was carried by a 75-kw. four-pole compound generator of the same voltage. The usual process of bringing the smaller dynamo to voltage and cutting in the equalising side was carefully gone through with. The instant the main switch was thrown a series of events transpired that came too rapidly to be put carefully on record.

A flash at the switch, the dying down of the lights, the crash of flying material, and the throwing off of the belt is the order of events as nearly as they can be given. It would be perfectly useless to attempt to judge from appearances just which happened first, whether the belt was thrown before the commutator went to pieces or after.

The above seems within the range of possibilities, but a look at the machine seems to indicate something different, and makes matters somewhat complicated. The armature indicates in every way that, at the time the commutator was thrown, it was running in a direction opposite to that of the engine. If this was the case the belt was thrown before the commutator went to pieces.

The engine, which is rated at 50 horse-power, did not appear to race, and continued running quietly after the accident. The writer, who was present, is sure the dynamo was up to voltage, and thinks the attendant at the board pulled the switch almost instantly after it was indicated that something was wrong.

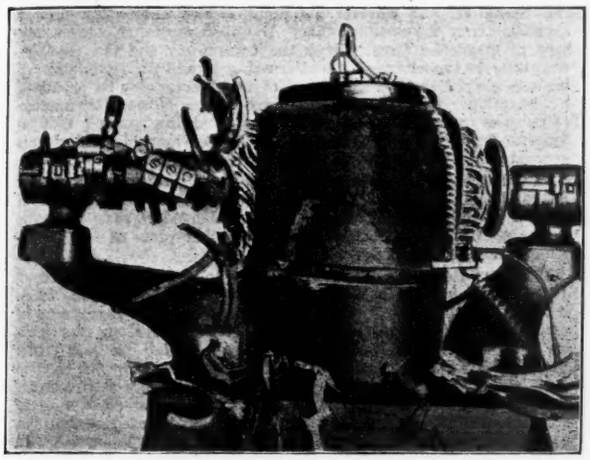
It can be seen in the illustration that the segments indicate a direction of rotation over and toward, while the engine causes a rotation over and from, the point of view.

* Abstract (New York *Electrical World*) of paper presented to the American Association for the Advancement of Science, Boston, August, 1898.

* *Phil. Mag.*, August, 1896.
† Kinsley, *Phil. Mag.*, April, 1898.
‡ Lord Rayleigh, "Theory of Sound."

The dynamo is protected by fuses, but these were not blown. A weakness is found in the commutator, but it would hardly seem possible that at the normal speed of 1,300 revolutions per minute the centrifugal force alone would cause destruction. It will be noticed that the segments, of which there are 60, have a short bevel at the ends, and that they are of quite a length. This end of the armature was well protected with canvas and three bands of wire.

The force with which the segments were thrown can be imagined when it is said that one went through a cupboard door 1 inch in thickness, cutting a clean hole; another passed through a window, carrying a part of the sash with it. The



oak base presented the same appearance that it would if an inexperienced axeman had given an exhibition of his skill at mutilation. The canvas head was torn in shreds, and this, with the mica, was scattered all over the power house.

No one was hurt. The writer had just left a position that was in line of the flying parts. Mauser bullets would have been preferable to the flying segments.

A plausible theory as to the cause, but one which is not corroborated by present indications, is that, after the dynamo was cut in, the shunt circuit became broken, making a series motor, thus changing the direction of rotation.

REVIEWS.

Steam Boilers and their Heat Efficiency. By Bryan Donkin. London: Charles Griffin & Co. 1898.

This is a most useful book, for it is rather a record of facts than a mere theoretical dissertation.

It is a collection of many tests made upon many boilers of all sorts, and as such it is a record of what has been done, and these tests form a rough datum line from which to start comparisons. It is all very well and proper to make boiler and engine tests upon close lines as to heat balance, but the steam user who is evaporating only 5 lbs. in a boiler of a type which is known to regularly give a result of 8 lbs. wants to know why this is so, and cannot himself take cognisance of the reasons. With other results before him he knows there is something wrong, and must then choose his method of setting matters right. No fewer than 425 separate experiments are here tabulated under 25 columns. Following the tables is a chapter on fire grates, one also on mechanical stokers, both chiefly descriptive. Then follows a chapter on combustion, dealing with the chemistry of the subject and the admission of air, and there are subsequent chapters on heat transmission, economisers and smoke, all full of the most useful information. Ringelmann's smoke scale is described, and pronounced good. We have ourselves used this scale in smoke determination, and can speak to its excellence and convenience.

The remainder of the book is equally of interest, the whole forming an exceedingly valuable encyclopædia of facts relative to steam raising in all its aspects. We have pleasure in recommending it to all steam users and steam engineers.

Aerial or Wire Rope Tramways. By A. J. Wallis-Tayler. London: Crosby Lockwood & Co. 1898.

Undoubtedly there is a wide field for telpherage and other forms of wire tramways. Over rough country, the laying of an ordinary railway, of the lightest description, involves more or less grading work. In a wire system the work is confined to post hole digging. The system is also cheap, and can be usefully employed as the pioneer system in new country, or as a means of moving produce in even older settled colonies, and from mines that cannot afford more expensive systems. The excellence of the modern steel rope enables immense spans to be covered and lines to be set up in otherwise inaccessible regions. The book before us deals with the subject of wire tramways, its spans, general arrangements, details, rope strengths, splicing and treatment. The ropes employed are stated to be best of the Albert or Lang lay, by which is meant that the strands forming the rope are laid in the same direction as to twist as the wires forming the strands. Such ropes run more flexibly, and there is less strain on the separate wires, which do not break so readily as in an ordinary twist, and wear to a flat, smooth surface, almost like a solid bar. Altogether, if not a very large and scientific treatise, the author has brought into a small compass a large amount of information.

Second Stage Mathematics. Edited by William Briggs, M.A., LL.B., F.C.S., F.R.A.S. London: W. B. Clive, University Correspondence College Press.

We have received from the University Correspondence College Press a recent addition to their Organised Science Series. It contains the pure mathematics required for the second stage examination of the Science and Art Department beyond what is required for the first stage. This includes the Second, Third, and Fourth Books of Euclid, the solution and theory of quadratic equations, with indices, surds, and the rules of ratio and proportion, trigonometry as far as the solution of triangles, and the use, for that purpose, of logarithms. The collection into one small volume of all the matter to be got up for one examination is convenient and economical. The book is a convenient size for the pocket and well printed. It seems to be very suitable for its purpose, and the details of its arrangement and typography bear evidence of care and experience in its preparation.

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS.—1898.

Compiled expressly for this journal by W. P. Thompson & Co, Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, Manchester, and Birmingham, *to whom all inquiries should be addressed.*

20,774. "Improved conduit for electric traction." E. Jennings and C. E. Malley. Dated October 3rd.

20,794. "Improvements in electric signalling apparatus for ships." R. von Horvath and M. Cohn. Dated October 3rd. (*Complete.*)

20,823. "Improvements in or connected with electric arc lamps." G. T. Davies. Dated October 3rd.

20,829. "Improvements in electric generators and motors." A. Bocquentin. Dated October 3rd.

20,832. "Improved arrangement for the electric lighting of railway carriages with the assistance of wind motors." S. Stuckgold. Dated October 3rd. (*Complete.*)

20,847. "Improvements in electro-motors and dynamos." W. Peck. Dated October 4th.

20,850. "Improvements in and in relation to the trolley head of electric tram cars." J. W. Towde. Dated October 4th.

20,894. "Improvements in trolley cars for electric railways." The British Thomson-Houston Company, Limited. (H. Geisenhoener, United States.) Dated October 4th. (*Complete.*)

20,895. "Improvements in electric surface contact railway systems." The British Thomson-Houston Company, Limited. (W. B. Potter, United States.) Dated October 4th. (*Complete.*)

20,904. "Improvements in underground conduits for electrical conductors." E. S. Clark. Dated October 4th.

20,919. "An improved electrolyte for primary batteries." R. J. Crowley, S. S. Bromhead, and H. Fairbrother. Dated October 4th.

20,923. "Improvements in arc lamps." W. Crudgington. Dated October 4th.

20,945. "Improvements in electro-magnetic machines." J. M. Hiley. Dated October 5th.

20,956. "Improved non-conducting material or composition and process for the production of same." L. Pirwitz and W. Behr. Dated October 5th. (*Complete.*)

20,972. "An improvement in the adaptation of the telephone to 'electric bell pushes,' such as are used in ordinary bell and indicator systems for private houses, offices, hotels, &c." G. L. Andres and A. J. Wilson. Dated October 5th.

20,989. "A new or improved composition for electrically firing detonators." G. P. Bickford-Smith. Dated October 5th. (*Complete.*)

20,991. "Improvements in or relating to phonographs." J. Cohn and J. S. August. Dated October 5th. (*Complete.*)

20,994. "Improvements in or connected with electric regulating switches." O. D. Lucas. Dated October 5th.

21,002. "A new or improved construction of electric glow lamp applicable for general lighting purposes." T. E. Andrews. Dated October 5th.

21,005. "Improved end connections for electric cables." W. T. Henley's Telegraph Works Company, Limited, and R. O. Wright. Dated October 5th.

21,025. "Improvements in electric arc lamps." English Industrials, Limited, and G. E. Heyl-Dia. Dated October 6th.

21,043. "Improvements in electric meter systems." The British Thomson-Houston Company, Limited. (E. W. Rice, jun., United States.) Dated October 6th. (*Complete.*)

21,044. "Improvements in prepayment electric meters." The British Thomson-Houston Company, Limited. (F. P. Cox, United States.) Dated October 6th. (*Complete.*)

21,045. "Improvements in speed indicators for electric motors." The British Thomson-Houston Company, Limited. (E. J. Berg, United States.) Dated October 6th. (*Complete.*)

21,046. "Improvements in electric meters for alternating current circuits." The British Thomson-Houston Company, Limited. (A. G. Davis, United States.) Dated October 6th. (*Complete.*)

21,047. "Improvements in electric fuses." The British Thomson-Houston Company, Limited. (W. Le Roy Emmet, United States.) Dated October 6th. (*Complete.*)

21,048. "Improvements in prepayment electric meters." The British Thomson-Houston Company, Limited. (E. Allo, United States.) Dated October 6th. (*Complete.*)

21,079. "Improvements in rotary motors." X. C. L. G. Vandel. Dated October 6th.

21,125. "Improvements in and relating to the electrical communication of signals." H. Mechan and D. Muirhead. Dated October 7th.

21,129. "An improved instrument for the measurement of magnetic permeability, magnetic hysteresis, magnetic induction, and other quantities." W. Peddie. Dated October 7th.

21,150. "Improvements in or connected with electric traction by means of underground conduits." E. Hungerbuhler. Dated October 7th.

21,155. "Improvements in electrically-propelled vehicles." J. P. Juvenet. (E. M. D. de Siblas, France.) Dated October 7th.

21,165. "Method of, and appliances for, exciting alternating current dynamo machines whether acting as generators or as motors." C. D. Abel. (La Societe Anonyme Pour La Transmission de la Force par L'electricite, France.) Dated October 7th.

21,169. "Improvements in electric batteries." R. Haddan. (Columbus Electrizitats Gesellschaft (Limited Company), Germany.) Dated October 7th.

21,172. "A new or improved method and means of electrically operating apparatus such as valves, electrical switches, or the like." C. O. Bastian and F. M. Staunton. Dated October 7th.

21,201. "Improvements in hydro-pneumatic accumulators." J. S. Stevens, C. G. Major, and E. C. Stevens. Dated October 8th.

21,216. "An improved trolley for taking electric current, applicable to the electric traction of vehicles, boats, and the like." L. L. Gerin. Dated October 8th. (*Complete.*)

21,224. "Improvements in or relating to electric clocks or watches." E. Rosi and G. Vacotti. Dated October 8th. (*Complete.*)

21,233. "Improvements in apparatus for coating metal articles by electro-deposition." J. Thornton and T. R. Canning. Dated October 8th.

21,240. "An improved telephone call counter." F. M. Richter. Dated October 8th. (*Complete.*)

21,241. "Improvements in telephone switchboards." F. M. Richter. Dated October 8th. (*Complete.*)

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, Manchester, and Birmingham, *price, post free,* 9d. *(in stamps).*

242. "Improvements in electric time pieces or clocks." F. Richard and F. Teutz. Dated December 23rd, 1897. Relates to clocks or timepieces in which the motive power is an electric current furnished by any suitable means. The hollow base of the clock supports standards upon which are carried the dial and a suitable train of gears, and a supporting plate which carries the contact spring and a bearing for one end of the balance spindle. Within the hollow base the cell or dry battery is fastened by two metal brackets, which are attached to and insulated from the base, and provided with downward extending slotted arms, into which fit the studs forming the terminals of the battery, so that when the binding screws are tightened upon the arms a positive contact is made and the battery held in position. 4 claims.

4,820. "Improvements in electric arc lamps." Siemens Bros., Ltd., and F. Booker. Dated February 26th, 1898. This relates to a brake clutch wheel for the regulating mechanism of an electric arc lamp. 1 claim.

9,779. "Improvements in testing and protecting apparatus used in conjunction with telephone, telegraph, or other electrical circuits." D. Sinclair and W. Aitken. Dated April 28th, 1898. In this invention there is an arrangement of parts forming test boards, comprising of apparatus for joining the line wire to the inside of the switchboard wire. The switchboard parts are protected from lightning. There is also a combination of lightning arresters and fuse coils, with a local circuit having an indicator to show on what cable head a fuse has gone, and a bell common to a number of indicators to give alarm. 6 claims.

10,883. "Apparatus for transmitting motion to a distance by means of electrical energy." Siemens Bros. & Co., Ltd. Dated May 12th, 1898. The specification refers to 8,041 (1897), in which the transmitter and receiver are supplied with alternating current excitation from the same machine. By this invention it is not necessary to magnetise directly both the transmitter and the receiver, according to the nature of the alternating current; the excitation of the one part of the transmitter or of the receiver may be produced by induction. The advantage obtained by this is, that the number of necessary wires is diminished, and that sliding contact may be dispensed with for the one apparatus, since the movable part of this apparatus is not supplied with direct current. 2 claims.

12,349. "Improvements in microphones." Siemens Brothers. Dated June 1st, 1898. Relates to a simplified construction of microphone wherein the membrane is so arranged as to serve at the same time for the attachment of all the other parts of the microphone. 1 claim.

12,699. "Improvements in or relating to electric transformers." J. J. Bellman and C. T. Rittenhouse. Dated June 7th, 1898. According to the present invention the magnetic field is made up of plates or layers of magnetic material, continuous along the path of the magnetic flux, and without air-gaps or lap or butt joints therein. The core or portion of the field surrounded by the electric conductor is of substantially or approximately circular cross section, and the spool for the electric conductor is of circular cross section, and divided or sectional so that it may be inserted within the openings about the core in the integral plates or layers of the field when the spool is rotated for the purpose of winding the electric conductor on the spool and around the core, and thus the operation of winding the coils is exceedingly simple and may be rapidly performed. 7 claims.

13,113. "Improvements in protectors and holders for electric incandescent lamps, thermometers and other articles." F. Hughes. Dated May 21st, 1898. Relates to improvements in connection with holders for incandescent lamps and other articles. In holders for incandescent lamps a split socket for receiving the lower end of the lamp is employed, the lamp being screwed or otherwise attached to a suitable base having central contact pieces for conveying the electric current to the lamp. 3 claims.

13,477. "Commutator brush holders and brushes for electric machines." E. H. Johnson and R. Lundell. Dated June 16th, 1898. This invention consists of a brush holder having an arm or stud adjustably secured to a rocker arm in combination with a pair of brushes located side by side, and resting against each other, together with a pair of brush supporting springs secured at one end to the arm or stud mentioned above, and at the other end to contact blocks to which the brushes are clamped, and adjustable means connecting the springs with the arm or stud, with or without means for varying the pressure of the brushes on the commutator. 4 claims.

13,709. "Improvements in or relating to the electric propulsion of railway trains." O. H. E. Kaselowsky. Dated June 20th, 1898. Relates to the electric propulsion of railway trains in which the electrical energy is generated on a moving power station travelling with the train, and is supplied to motors distributed over the whole length of the train. In the arrangement of the two separate controlling places each is provided with a controlling apparatus, in which the controller bars are connected with the dynamo, as also with a secondary battery placed in the travelling power station by means of a common conductor provided with couplings between the cars and the separate contacts of both controlling apparatus. 1 claim.

13,960. "Electrodes for accumulators." H. Damm. Dated June 24th, 1898. In electric accumulators as ordinarily constructed, the object is to obtain a maximum of surface in relation to the weight unity of the electrode. For this purpose the present invention attains this object by making use of wire web, which supports the active material of the said electrode. On a frame which is provided with the well known butt ends and terminals, a wire which is made of lead, or other suitable material, is stretched or inserted. This web is connected with the frame in any suitable manner. 1 claim.

15,733. "Improvements in electric telephone transmitters." A. M. Massari. Dated July 18th, 1898. Relates to electric telephone transmitters, and has for its object an efficient transmitting instrument of simple construction that can be readily repaired when necessary, and in which the transmission can be very delicately regulated. It consists of a plate of insulating material, preferably of ebonite, having a central opening therein, and having the sleeves formed on, or attached thereto. A mouthpiece is attached to the insulating sleeve, preferably by means of screws. A hollow cylinder, which has an annular groove on its outer periphery and has an internal recess formed at one end, fits over the insulating ring and is secured to it. A tube passes through the plate and a cylinder, and has its screw-threaded end projecting beyond the latter, a coil spring situated between the plate and a shoulder formed by the internal recess in the cylinder. 4 claims.